Vol. 17, No. 3
March 1992

Energy Research Abstracts

Abstracts 6098–8450

Office of Scientific and Technical Information
UNITED STATES DEPARTMENT OF ENERGY

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Energy Research Abstracts

Coverage

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports and patent applications originated by the U.S. Department of Energy, its laboratories, energy centers, and contractors, as well as theses and conference papers and proceedings issued by these organizations in report form. Audiovisual materials, computer media (magnetic tapes, diskettes, etc.), and engineering drawings are included in this definition. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations, *provided* that the full text of the document has been received by OSTI. Foreign report information is obtained through the International Energy Agency's 14-nation Energy Technology Data Exchange, the International Atomic Energy Agency's International Nuclear Information System, or nation-to-nation agreements. The purpose of this publication is to announce documents produced or obtained by DOE that are not so readily available as journal articles, books, or patents. Please note that beginning with the January 1991 issue, *ERA* does not cover nonreport literature.

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The scope of *ERA* encompasses DOE's research, development, demonstration, and technology programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

The citations presented in *ERA* are available for online searching as records within the Energy Science and Technology Database (EDB). The current-year records are available on the Integrated Technical Information System (ITIS).

Availability

DOE and DOE contractors who have OSTI deposit accounts can obtain *ERA* (regular issues and annual indexes) from the Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37831, Attention: Information Services. For further information, call (615)576-8401, FTS 626-8401. *ERA* is also available at authorized GPO Depository Libraries. (List is provided on the inside back cover.)

ERA (regular issues and annual indexes) is available to the public on a subscription basis from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Managing Editor, Doris M. Henline
Technical Editor, Robert W. Rutkowski

Information Sources

The citations presented in *Energy Research Abstracts* are a subset of the worldwide energy information provided to the Office of Scientific and Technical Information (OSTI) through exchange agreements with foreign sources and through exchanges or contracts with U.S. organizations.

The **Energy Technology Data Exchange (ETDE)** was established by the International Energy Agency to promote cooperation among members in conducting appropriate energy-related research and development programs through the development of a formal central information sharing system. In accomplishing the objectives of the ETDE, members select, abstract, and index relevant research information published in their countries in accordance with Exchange standards. OSTI serves as the central receiving and processing center for this information, which it then disseminates to national centers in the participating countries. The following countries are currently members of the ETDE:

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- Norway
- Spain
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- Switzerland
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- United States

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The principal data elements included in these citations are:

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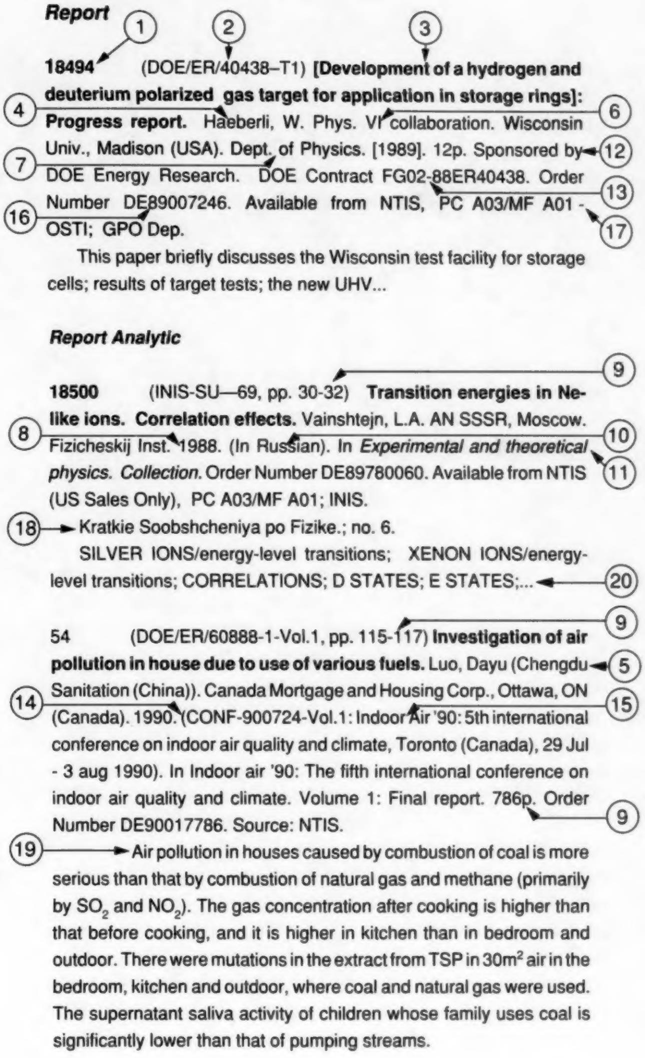
3. **Title and subtitle** (non-English title may appear in parentheses, if applicable).
4. **Author(s).** First 10 names in the data record are printed, then "et al." is listed.
5. **Author affiliation.** Only first one is listed, in parentheses after author(s) to which it applies.
6. **Collaboration,** if present.
7. **Corporate author(s)** identifying corporation responsible for document.
8. **Date of publication.** If not known, a processing date is in brackets.
9. **Number of pages** or page range. Prices are based on total pages unless special pricing applies.
10. **Language** of document if non-English.
11. **Monograph title** if citation is an analytic (part, chapter, or paper) of a larger monograph.
12. **Sponsoring organization.**
13. **Contract or grant number.**
14. **Secondary identifying number;** may be a conference number.
15. **Conference title, location, and date,** if applicable.
16. **Order number.** The "DE" order number may be used for ordering from NTIS or OSTI, as appropriate. The "TI" prefix is valid only at OSTI.
17. **Sources of availability** from which a copy of the document may be obtained; usually appear as abbreviations. (See information on following page.)
18. **Drop note** or explanatory statement.
19. **Abstract.**
20. **Subject descriptors.** Listed only if no abstract or only a brief statement is included.

Sample Citations



Report

18494 (DOE/ER/40438–T1) **[Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report.** Haeberli, W. Phys. VI collaboration. Wisconsin Univ., Madison (USA). Dept. of Physics. [1989]. 12p. Sponsored by DOE Energy Research. DOE Contract FG02-88ER40438. Order Number DE89007246. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper briefly discusses the Wisconsin test facility for storage cells; results of target tests; the new UHV...

Report Analytic

18500 (INIS-SU—69, pp. 30-32) **Transition energies in Ne-like ions. Correlation effects.** Vainshtejn, L.A. AN SSSR, Moscow. Fizicheskij Inst. 1988. (In Russian). In *Experimental and theoretical physics. Collection.* Order Number DE89780060. Available from NTIS (US Sales Only), PC A03/MF A01; INIS.

Kratkie Soobshcheniya po Fizike.; no. 6.

SILVER IONS/energy-level transitions; XENON IONS/energy-level transitions; CORRELATIONS; D STATES; E STATES;...

54 (DOE/ER/60888-1-Vol.1, pp. 115-117) **Investigation of air pollution in house due to use of various fuels.** Luo, Dayu (Chengdu Sanitation (China)). Canada Mortgage and Housing Corp., Ottawa, ON (Canada). 1990. (CONF-900724-Vol.1: Indoor Air '90: 5th international conference on indoor air quality and climate, Toronto (Canada), 29 Jul - 3 aug 1990). In Indoor air '90: The fifth international conference on indoor air quality and climate. Volume 1: Final report. 786p. Order Number DE90017786. Source: NTIS.

Air pollution in houses caused by combustion of coal is more serious than that by combustion of natural gas and methane (primarily by SO_2 and NO_2). The gas concentration after cooking is higher than that before cooking, and it is higher in kitchen than in bedroom and outdoor. There were mutations in the extract from TSP in $30m^2$ air in the bedroom, kitchen and outdoor, where coal and natural gas were used. The supernatant saliva activity of children whose family uses coal is significantly lower than that of pumping streams.

How To Order from the Availability Sources

TO OBTAIN A REPORT

Report literature, usually identified by an alphanumeric identifier at the beginning of a citation, is available from the sources listed in the citation (see example of element 2 on page iii). Often the sources are listed as abbreviations. Corresponding addresses are provided at right from which documents with these abbreviations may be ordered. When "OSTI" is given, **DOE and DOE contractors may order these documents from OSTI.** (However, check with your library or information organization which may require that orders go through them to OSTI.) OSTI prices are based on total pages unless special pricing applies. The public should order from NTIS or from one of the other agencies listed in the citation. NTIS price codes may continue to appear in some records. To expedite processing, an order form is provided in the back of this publication. NOTE: The order numbers provide quicker access for report ordering. Use the order number where possible.

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GPO Dep.	Available for inspection or interlibrary loan at Government Printing Office regional depository libraries.
INIS	*Available only in microfiche.* INIS Clearinghouse International Atomic Energy Agency P.O. Box 100, A-1400 Vienna, Austria
NTIS	U.S. Department of Commerce National Technical Information Service 5285 Port Royal Road Springfield, VA 22161
OSTI	U.S. Department of Energy Office of Scientific and Technical Information P.O. Box 62 Oak Ridge, TN 37831

How To Use the Indexes

Five indexes are provided for approaching the content of each issue of *Energy Research Abstracts*. Descriptions of entries in these indexes follow.

Corporate Author Index

The corporation, organization, or institution responsible for the issuance of the document is listed in this index. The entries are arranged alphabetically and provide the title and citation number of the reference. For example, the listing for the "Report" sample citation would appear as shown at right.

Wisconsin Univ., Madison (USA). Dept. of Physics
[Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report, 15:18494 (R;US)
Wisconsin Univ., Madison (USA). Lab. of Genetics
Organization of the R chromosome region in maize: Final progress report, June 1, 1983–May 31, 1986, 15:18255 (R;US)

Personal Author Index

Each author's name listed on a document cited in this issue is indexed. An index entry provides title and citation number; for secondary and other names, a cross-reference is given to the primary author name where the full index entry is located.

Hadley, D.L., *See* Lee, A.D., 15:17651
Haeberli, W., [Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report, 15:18494 (R;US)

Subject Index

This index lists the main subject descriptors assigned to each record by indexing professionals. A secondary or qualifier term is used where necessary to describe materials, objects, and processes. Document titles may be enhanced with additional informative phrases where necessary. An excerpt from this index appears at right.

HYDROGEN ISOTOPES
See also DEUTERIUM
HYDROGEN 4
TRITIUM
Neutron-Rich Isotopes
Study on the strong neutron-rich nuclei of lightest elements, 15:18686 (RA;SU;In Russian)

Contract Number Index

DOE technical reports are listed by contract number. Each entry also provides the primary corporation or organization cited for that contract number. A typical entry is shown.

FG02-88ER40438 **Wisconsin Univ., Madison (USA). Dept. of Physics**
15:18494 DOE/ER/40438–T1
FG02-88ER60664 **Rogers and Associates Engineering Corp., Salt Lake City, UT (USA)**

Report Number Index

Technical report literature is indexed by the alphanumerical identifier of the report. Patent documents and conferences are included for convenience. Each entry lists the citation number, the source of availability of the document, an indicator of presence at a GPO depository library, order number, and distribution category. A typical entry is:

DOE/ER/40438–
T1 15:18494 NTIS, OSTI E 1.99: DE89007246 MF-411

Subject Contents

The subject content of *Energy Research Abstracts* is arranged as shown below. The two-digit and four-digit category numbers printed here illustrate the category number assignment used in the database records.* The following list includes all of the 38 first-level and the 313 second-level categories. Because each issue of *ERA* publishes citations only for those documents announced during the past semimonthly period, some subject categories may not be present in every issue.

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*The numerical subject category scheme is used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's data systems. Categories and definitions for the complete set of six-digit numbers are given in ETDE/PUB--1-R1, *International Energy: Subject Categories and Scope.*

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Energy Research Abstracts

01 COAL, LIGNITE, AND PEAT

6098 (DOE/EIA–0292(89)) **An assessment of the quality of selected EIA data series: Coal data, 1983–1988.** USDOE Energy Information Administration, Washington, DC (United States). Office of Statistical Standards. 25 Nov 1991. 85p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. Order Number DE92004652. Source: OSTI; NTIS; GPO; GPO Dep.

The purpose of this report is to present information on the quality of some of the Energy Information Administration's (EIA) coal data. This report contains discussions of data on production, direct labor hours, recoverable reserves, and prices from 1983 through 1988. Chapter 2 of this report presents a summary of the EIA coal data collection and identifies other sources providing similar data. Chapters 3 and 4 focus on data on coal production and direct labor hours, respectively. Detailed comparisons with data from the Mine Safety and Health Administration (MSHA) and State mining agencies are presented. Chapter 5 examines recoverable reserves. Included are internal comparisons as well as comparisons with other published reserve-related data, namely those of BXG, Inc. Chapter 6 describes how EIA obtains estimates of coal prices and discusses the variability in the prices caused by factors such as mine type, coal rank, and region. 5 figs., 5 tabs.

0103 Preparation

Refer also to citation(s) 6201, 6202, 6212, 6213, 6214, 6221, 6275, 6285, 6554, 6558

6099 (CONF-910571–, pp. 54-68) **Preparation of dewatered and deashed low-rank coals by oil agglomeration.** Musich, M.A. (Univ. of North Dakota, Grand Forks (United States)); DeWall, R.A.; Timpe, R.C. North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. [1991]. From 16. biennal low-rank fuels symposium; Billings, MT (United States); 20-23 May 1991. In *Proceedings of the sixteenth biennial low-rank fuels symposium.* 535p. Order Number DE92002606. Source: OSTI; NTIS; INIS.

The University of North Dakota Energy and Environmental Research Center (EERC) has developed an oil agglomeration process for low-rank coal (LRC) which produces a low-ash, low-moisture feedstock suitable for combustion and/or conversion (i.e., gasification, liquefaction). The EERC oil agglomeration process is divided into a high-shear coal-cleaning step and a low-shear agglomeration step. During the first step, a large percentage of the ion-exchangeable alkali metals (calcium, magnesium, sodium and potassium) are leached from the coal matrix. Simultaneously, this ion-exchange conditions the surface of the coal to make it more amenable to agglomeration. Low-shear mixing produces nearly spherically shaped agglomerates whose size can be controlled by the amount of bridging oil, time of mixing, and the geometry of the mixing system. Thermal deoiling of the raw agglomerates recovers the bridging oil for recycle, but leaves a portion of the oil to permanently bind the carbonaceous coal material together. The process has been tried, successfully, on four North Dakota lignites, three Wyoming subbituminous coals, and one Alaskan subbituminous coal. A number of low-value, coal- and petroleum-derived oil fractions have been tested as agglomerating agents. Ash reductions have ranged from 36 to 53 wt% for the subbituminous coals and from 71 to 79 wt% for the lignitic coals. More impressively, agglomeration followed by air drying has reduced the moisture content by 80 to 94 wt%. This paper describes the EERC oil agglomeration process, the hypothesized mechanism of low-rank coal agglomeration, and the effect of the operating parameters on various product qualities.

6100 (CONF-910571–, pp. 69-83) **Western Energy Company Advanced Coal Conversion process.** Sheldon, R.W. (Western Energy Co., Butte, MT (United States)); Rosholt, D.L.; Kujawa, S.T. North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. [1991]. From 16. biennal low-rank fuels symposium; Billings, MT (United States); 20-23 May 1991. In *Proceedings of the sixteenth biennial low-rank fuels symposium.* 535p. Order Number DE92002606. Source: OSTI; NTIS; INIS.

The Advanced Coal Conversion process (ACCP) consists of three process steps: drying, cooling and cleaning. These steps are described below for the demonstration plant being built in Colstrip, Montana. ASTM coal classification standards demonstrate that the subbituminous C coal feedstock is converted by the ACCP to a synthetic fuel classified as a high volatile bituminous C coal. As noted above, the synthetic upgraded coal product exhibits the characteristic of reduced pore volume, reduced oxygen, reduced hydrogen and increased aromaticity. The coal product has a reduced equilibrium moisture level and increased heating value; it retains a majority of its volatile matter with favorable ignition characteristics.

6101 (CONF-9106303–, pp. 31-32) **A new approach in ultrapurification of coal by selective flocculation.** Moudgil, B.M. (Univ. of Florida, Gainesville (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-88PC88917. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The general objective of the present study was to separate fine coal from ash forming minerals and pyrites using selective flocculation technology. Specifically, a mathematical model based on the 'active' sites concept was to be developed so that experimental conditions to achieve the desired separations for a given coal sample could be predicted. Samples of Pittsburgh coal, coal refuse and coal pyrite were used for single component flocculation tests. It was revealed that separation of coal from coal refuse/coal pyrite may be possible with highly cationic (Superfloc 362) and a nonionic polyacrylamide (Superfloc 16). However, selectivity indicated by single component tests was not realized in mixed mineral floccualtion tests. A major accomplishment of the research conducted is that a mathematical and computational model capable of predicting the optimum selectivity achievable with a given polymer has been developed and successfully verified experimentally.

6102 (CONF-9106303–, pp. 33-35) **Enhancement of surface properties for coal beneficiation.** Chander, S. (Pennsylvania State Univ., University Park (United States)); Aplan, F.F. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-88PC88934. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The need to clean coal for its effective utilization in steam generation is well recognized. To use the coal as a source of energy in an environmentally safe manner, pre-combustion desulfurization is considered to be a very cost-effective method. The main objective of this research project is to study ways to modify surface properties of coal, pyrite and ash-forming mineral matter for beneficiation of fine coal. Since the differences in surface properties of coal and mineral matter are utilized in several oil based preparation technologies, such as: froth flotation, emulsion flotation, spherical agglomeration and liquid-liquid separation, another objective is to delineate the role of oil. The following studies are being carried out to achieve the objectives stated in the previous paragraph: investigation of the natural hydrophobicity of coal and pyrite; development and evaluation of enhanced coal hydrophobicity; development and evaluation of reagents which modulate the hydrophobicity of pyrite;

development and evaluation of emulsion processes and their underlying principles.

6103 (CONF-9106303–, pp. 36-37) **Pelletization of fine coals.** Sastry, K.V.S. (Univ. of California, Berkeley (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-89PC89766. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The primary goal of this project is to provide the coal industry with a formal understanding and basis for selection, design and operation of coal pelletizing systems. Four specific research topics are chosen towards this end. These include - development of a unified agglomeration index for correlating growth and strength characteristics of coal fines, identification and development of methods for coal pellet characterization, surface (physical and chemical) principles of coal pelletization, and the role of binders and basis for binder selection. During the last one year, the research was concerned primarily with: investigations on the method of production of coal fines, the batch pelletization behavior of the base coals to establish the moisture requirements for pelletization, the extent of oxidation of coals, and the type and amount of additives; mathematical modeling investigations to aid in the fundamental understanding of the coal pelletization process; and exploratory studies on the methods for coal pellet characterization. Pelletization of coal fines can be primarily characterized by the amount of moisture required for pelletization which is determined by the coal properties. Kinetics of coal pelletization is discovered to be highly sensitive to minor variations in the coal properties during storage (oxidation) and during cleaning steps (flotation). The current efforts are being directed to understanding the reasons for this sensitivity and to find practical engineering solutions.

6104 (CONF-9106303–, pp. 38-40) **Control of pyrite surface chemistry in physical coal cleaning.** Luttrell, G.H. (Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (United States)); Yoon, Roehoan. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-89PC89789. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The primary objective of this research is to obtain fundamental knowledge concerning the surface properties of coal pyrite as they relate to advanced physical coal cleaning (APCC) processes. This objective will be met by (1) investigating the mechanisms responsible for the inefficient rejection of coal pyrite and (2) developing schemes for improving the rejection of coal pyrite based on information gathered from part (1). Studies conducted during the first year of this project indicate that the flotation recovery of coal pyrite may be attributed to (1) the presence of hydrophobic inclusions of carboneous material or (2) the formation of hydrophobic oxidation products, such as metal polysulfides, on the pyrite surfaces. In light of these findings, two different approaches were examined during the past year for improving pyrite rejection. The first approach involved the testing of organic depressants which are capable of selectively depressing pyrite particles containing carboneous material. The second approach focused on the development of reagents which create a reducing environment, thereby preventing the formation of hydrophobic oxidation products on the pyrite surfaces. Accomplishments of the research conducted to date are as follows: The hydrophobicity of coal pyrite is induced by superficial oxidation and/or the presence of carbonaceous material. Reducing the pulp potential is an effective means of preventing coal pyrite from acquiring hydrophobicity without deleterious effects on coal flotation. A novel organic depressant has been synthesized which contains no sulfur group in its structure.

6105 (CONF-9106303–, pp. 49-50) **Hydrocarbon-oil encapsulated bubble flotation of fine coal.** Peng, F.F. (West Virginia Univ., Morgantown (United States)); Eung Ha Cho. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The overall objective of the project is to obtain the flotation rate data using two types of bench scale flotation experiments to evaluate the effectiveness of oil-encapsulated bubble flotation for six ranks of coal. The six ranks of coal are Upper Freeport seam, Lower Kittaning seam, Pittsburgh seam, Wyodak seam, lignite and anthracite. The flotation cells are a stirred tank cell and a column flotation cell. When a mixture of air and gasified collector, such as kerosene, is dispersed into flotation cell, the oil-coated air bubble are created. This new collector dispersion technique applied in coal fine flotation will be compared with the flotation results obtained from using (1) direct collector addition, (2) ultra-sonically collector emulsifying and (3) atomizing collector addition techniques. The rate data and the surface characteristics of coal particles and oil-coated air bubbles will be correlated to achieve an understanding of the mechanisms of oil-coated bubble flotation on various ranks of coal for industrial applications. This period of work emphasized on establishing the testing methods and procedures for characterization of coal particle surfaces and oil-coated bubbles, as well as measurement of flotation responses for six ranks of coal, by using four different collector dispersion techniques. Upper Freeport seam coal was used in development of flotation procedures, and the hydrophobicity of coal particles determination. Similar procedure and instruments will be extended to study other five coals for comparison purposes.

6106 (CONF-9106303–, pp. 141-142) **Characterization of multiphase flow during air-sparged hydrocyclone flotation by X-ray CT.** Miller, J.D. (Univ. of Utah, Salt Lake City (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-90PC90311. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

Recent research carried out at the University of Utah indicates that X-ray computed tomography (CT) can provide a new dimension in the analysis of multiphase fluid-flow behavior. With such measurements, dispersed-phase concentration gradients in the swirl layer and froth phase of the air-sparged hydrocyclone can be determined during the actual flotation process. In this regard, the phenomenological details of multiphase flow in the air-sparged hydrocyclone are to be examined by X-ray computed tomography. In this program it is anticipated that time-averaged density variations can be established as a function of design and operating variables in order to more fully explain the observed flotation response of coal slurries and the extent to which ash and sulfur can be eliminated.

6107 (DOE/OR/03054–120) **SRC-I computer model.** Hardman, S.A. (UOP, Inc., Des Plaines, IL (United States). Process Div.); Landry, W.E. International Coal Refining Co., Allentown, PA (United States); UOP, Inc., Des Plaines, IL (United States). Process Div. Jun 1984. 368p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC05-78OR03054. Order Number DE92005192. Source: OSTI; NTIS (documentation only); ESTSC (complete software package), P.O. Box 1020, Oak Ridge, TN 37831-1020; GPO Dep.

Synfuels projects face considerable technical, political, and economic risks. This computer model (the SRC-I Computer Model) of an SRC-I Coal Liquefaction Facility was produced to assist in determining if there is sufficient profit incentive to justify the assumption of these risks. Venture analysis, using this model as a decision making tool, can clarify the relationship between plant size, plant configuration, and profitability. This model uses estimates of capital and operating cost, applied within the constraints of the anticipated business environment, to determine the economic merit of a project. (VC)

6108 (DOE/PC/79865–T1-Vol.3) **Development of clean coal and clean soil technologies using advanced agglomeration techniques: Volume 3, Soil Clean-up and hydrocarbon waste treatment process: ARC/EPRI Consortium Coal Processing**

Development Program. Ignasiak, B.; Ignasiak, T.; Szymocha, K. Alberta Research Council, Devon, AB (Canada). Coal and Hydrocarbon Processing Dept. Jan 1990. 67p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-87PC79865. Order Number DE92001740. Source: OSTI; NTIS; INIS; GPO Dep.

Three major topics are discussed in this report: (1) Upgrading of Low Rank Coals by the Agflotherm Process. Test data, procedures, equipment, etc., are described for co-upgrading of subbituminous coals and heavy oil; (2) Upgrading of Bituminous Coals by the Agflotherm Process. Experimental procedures and data, bench and pilot scale equipments, etc., for beneficiating bituminous coals are described; (3) Soil Clean-up and Hydrocarbon Waste Treatment Process. Batch and pilot plant tests are described for soil contaminated by tar refuse from manufactured gas plant sites. (VC)

6109 (DOE/PC/88925–T8) **Correlation of stability/rheology relationship with coal properties and chemical additives: Quarterly progress report, December 15, 1989–March 15, 1990.** Ohene, F. Grambling State Univ., LA (United States). Dept. of Chemistry. [1990]. 3p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-88PC88925. Order Number DE92005137. Source: OSTI; NTIS; GPO Dep.

The overall objective of this project is to perform experiments to evaluate the necessary boundary conditions in the preparation and utilization of Coal Water Slurries and also develop a data base for the conceptual analysis of a prescription to predict slurry quality for a given coal candidate.

6110 (DOE/PC/90167–T3) **Mulled coal—A beneficiated coal form for use as a fuel or fuel intermediate: Final technical progress report No. 3, October 1, 1990–December 31, 1990.** Energy International Corp., Pittsburgh, PA (United States). May 1991. 22p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-90PC90167. Order Number DE92004968. Source: OSTI; NTIS; GPO Dep.

The storage, transport and handling of beneficiated coals in the form of a modified wet cake ("mulled coal") to yield a coal water fuel having acceptable properties for atomization and combustion on industrial, commercial and/or residential scales, have been investigated. The Mulled Coal project is divided into a series of tasks designed to produce formulations and system designs suitable to convert fine coal "wet cakes" into a material that can be stored, handled, and transported to a site where it can be utilized as a fuel in existing and developing combustion devices. (VC)

6111 (DOE/PC/90167–T4) **Mulled coal: A beneficiated coal form for use as a fuel or fuel intermediate: Phase 1 feasibility studies: Final.** Energy International Corp., Pittsburgh, PA (United States). Oct 1991. 34p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-90PC90167. Order Number DE92004847. Source: OSTI; NTIS; GPO Dep.

Energy International is developing a technology that will create a staged formulation with the first coal form (Mulled Coal) that can be stored, transported, and pumped. Just prior to combustion, the Mulled Coal (MC) would be modified to provide the properties needed for proper atomization. This concept is an alternative to the expensive and energy intensive thermal drying processing of fine coal wet cakes. The material is suitable for both direct feed use in conventional and fluid bed combustors as well as on-site conversion to combustible slurries. By maintaining the coal form relatively close to the feed wet cake, only minor processing with low additive levels and low energy blending needed at the point of production. Its conversion to slurry or other use-feed form is made near the time of use and thus the requirements for stability, climatic control, and other storage, transport, and handling requirements are much less severe.

6112 (DOE/PC/90176–T49) **Dewatering studies of fine clean coal: Annual technical report, September 1, 1990–August 31, 1991.** Parekh, B.K. Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States). [1991]. 34p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-90PC90176. Order Number DE92004185. Source: OSTI; NTIS; GPO Dep.

The main objective of the present research program is to study and understand dewatering characteristics of ultrafine clean coal obtained using the advanced column flotation technique from the Kerr-McGee's Galatia preparation plant fine coal waste stream. It is also the objective of the research program to utilize the basic study results, i.e., surface chemical, particle shape particle size distribution, etc., in developing a cost-effective dewatering method. The ultimate objective is to develop process criteria to obtain a dewatered clean coal product containing less that 20 percent moisture, using the conventional vacuum dewatering equipment. (VC)

6113 (DOE/PC/90176–T57) **The effect of moderate coal cleaning on microbial removal of organic sulfur: Final technical report, September 1, 1990–August 31, 1991.** Srivastava, V.J. Institute of Gas Technology, Chicago, IL (United States). [1991]. 39p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-90PC90176. Order Number DE92004193. Source: OSTI; NTIS; GPO Dep.

The objective of this research is to provide data relevant to the development of an integrated physical, chemical, and microbiological process for the desulfurization of coal, utilizing existing technologies insofar as is possible. Specifically, the effect of increased surface area and porosity achieved by physical, chemical, and microbial treatments of coal on the subsequent microbiological removal of organic sulfur will be evaluated.

6114 (DOE/PC/90176–T59) **Recovery of fine coal from waste streams using advanced column flotation: Annual report, September 1, 1990–August 31, 1991.** Groppo, J.G. Kentucky Univ., Lexington, KY (United States). Center for Applied Energy Research. [1991]. 49p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-90PC90176. Order Number DE92004195. Source: OSTI; NTIS; GPO Dep.

The advanced flotation techniques, namely column flotation, have shown potential in obtaining a low ash, low pyritic sulfur fine size clean coal. The overall objective of this program is to evaluate applicability of an advanced flotation technique, 'Ken-Flote' column to recover clean coal with minimum mineral matter content at greater than 90 percent combustible recovery from two Illinois preparation plant waste streams. Column flotations tests were conducted on the flotation feed obtained from the Kerr-McGee Galatia and Ziegler No. 26 plants using three different bubble-generating devices: sparger, gas saver and foam jet. Each of these devices was tested with three different frothers and various column-operating variable to provide maximum combustible recovery, minimum product ash and maximum pyrite rejection. For the Galatia slurry, the column provided a clean coal containing 5 percent ash, 0.48 percent pyritic sulfur at combustible recovery averaging 90 percent. In other words, about 90 percent ash and about 75 percent pyritic sulfur rejection were attained for the Galatia slurry. Pilot plant studies on this slurry basically obtained results similar to the laboratory studies. For the Ziegler No. 26, slurry column flotation provided a clean coal containing about 5 percent ash, 0.44 percent pyritic sulfur at more than 90 percent combustible recovery. The ash and pyrite sulfur rejection was about 85 percent and 65 percent, respectively.

6115 (DOE/PC/90176–T61) **Recovery of coal fines from preparation plant effluents: Final technical report, September 1, 1990–August 31, 1991.** Choudhry, V. Praxis Engineers, Inc., Milpitas, CA (United States). [1991]. 31p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-90PC90176. Order Number DE92004197. Source: OSTI; NTIS; GPO Dep.

The objectives of this project were to test and demonstrate the feasibility of recovering coal fines that are currently disposed of with coal preparation plant effluent streams and producing a fine clean coal product that can be blended with the plant coarse clean coal. This recovery was effected by means of Michigan Technological University's static tube flotation process, which was successfully demonstrated on a number of raw coals to reject 85% of the pyritic sulfur and recover 90% of the combustible matter. Under this project, the process parameters for the technology were modified for this application in order to recover a low-ash, low-sulfur clean coal that is, at a minimum, compatible with the quality of the clean coal currently produced by the preparation plant.

6116 (DOE/PC/90176–T62) **Fine coal flotation plant waste comparison–column vs. sub-a cells: Final technical report, September 1, 1990–August 31, 1991.** Ehrlinger, H.P. III. Illinois State Geological Survey, Urbana, IL (United States). [1991]. 36p.

Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-90PC90176. Order Number DE92004198. Source: OSTI; NTIS; GPO Dep.

The objective of this project was to compare results from a small commercially sized Deister Flotaire column flotation cell with the subaeration cells at Kerr-McGee's Galatia plant during side by side testing of feed splits from the same sources. Typical cell criteria for both cells are included in the appendix. The project involved the activities of three organizations: the Kerr-McGee Coal Corporation, the Deister Concentrator Company, and the Illinois State Geological Survey. Their roles were as follows: Kerr-McGee installed the Deister column with sample splitter and tailings volume measuring cell in the Galatia Coal Preparation Plant to treat a representative split of their flotation feed; Deister provided a 30 inch diameter × 35′ high Deister Flotaire Column Flotation Cell capable of treating nominally one ton per hour or slightly over 1% of the plant feed. Deister additionally provided the sample splitter and the tailings volume measuring cell. ISGS personnel worked with both companies on the installation, conducted laboratory tests to direct the early plant test reagent practice, attended all of the plant runs cutting representative samples of feed, measuring slurry and reagent flows, preparing samples and writing reports.

6117 (DOE/PC/90176–T64) **Process development for production of coal/sorbent agglomerates: Final technical report, September 1, 1990–August 31, 1991.** Rapp, D.M. Illinois State Geological Survey, Champaign, IL (United States). [1991]. 32p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-90PC90176. Order Number DE92004071. Source: OSTI; NTIS; GPO Dep.

The goal of this work was to develop a process flow diagram to economically produce a clean-burning fuel from fine Illinois coal. To accomplish this, the process of pelletizing fine coal with calcium hydroxide, a sulfur capturing sorbent, was investigated. Carbonation, which is the reaction of calcium hydroxide with carbon dioxide (in the presence of moisture) to produce a bonding matrix of calcium carbonate, was investigated as a method for improving pellet quality and reducing binder costs. Proper moisture level is critical to allow the reaction to occur. If too much moisture is present in a pellet, the pore spaces are filled and carbon dioxide must diffuse through the water to reach the calcium hydroxide and react. This severely slows or stops the reaction. The ideal situation is when there is just enough moisture to coat the calcium hydroxide allowing for the reaction to proceed. The process has been successfully demonstrated on a pilot-scale as a method of hardening iron ore pellets (Imperato, 1966). Two potential combustion options are being considered for the coal/calcium hydroxide pellets: fluidized bed combustors and industrial stoker boilers.

6118 (DOE/PC/90177–T5) **Evaluation, engineering and development of advanced cyclone processes: Quarterly technical progress report No. 4, July 1, 1991–September 30, 1991.** Coal Technology Corp., Bristol, VA (United States). [1991]. 43p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-90PC90177. Order Number DE92005197. Source: OSTI; NTIS; GPO Dep.

"Evaluation, Engineering and Development of Advanced Cyclone Processes" is a research and development project for the reduction of pyritic sulfur in coal. Project goals are to remove 80 to 90% of the ash and pyritic sulfur while retaining 80 to 90% of the parent coal's heating value. A number of media and media separator options are to be evaluated and tested, culminating with the implementation of the preferred combination in a 1,000 lb/hr bench-scale process optimization circuit.

6119 (DOE/PC/90178–T4) **Selective flotation of fossil resin from Western coal: Quarterly report, June 1, 1991–August 31, 1991.** Jensen, G.F.; Miller, J.D. Utah Univ., Salt Lake City, UT (United States). 15 Oct 1991. 22p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-90PC90178. Order Number DE92004910. Source: OSTI; NTIS; GPO Dep.

Technical activities for the fourth quarter involved efforts by both the University of Utah and Advanced Processing Technologies, Inc. Laboratory research at the University of Utah was primarily concerned with surface chemistry/resin characterization, which has emphasized Fourier transform infrared analysis in the past quarter. APT's major activities included proof-of-concept plant testing of the fossil resin flotation circuit. (VC)

6120 (DOE/PC/90295–T3) **Pyrite surface characterization and control for advanced fine coal desulfurization technologies: First annual report, September 1, 1990–August 30, 1991.** Wang, Xiang-Huai. Kentucky Univ., Lexington, KY (United States). [1991]. 52p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-90PC90295. Order Number DE92005140. Source: OSTI; NTIS; GPO Dep.

The objective of this project is to conduct extensive studies on the surface reactivity of pyrite by using electrochemical, surface analysis, potentiometric and calorimetric titration, and surface hydrophobicity characterization techniques and to correlate the alteration of the coal-pyrite surface with the efficiency of pyrite rejection in coal flotation. The products as well as their structure, the mechanisms and the kinetics of the oxidation of coal-pyrite surfaces and their interaction with various chemical reagents will be systematically studied and compared with that of mineral-pyrite and synthetic pyrite to determine the correlation between the surface reactivity of pyrite and the bulk chemical properties of pyrite and impurities. The surface chemical studies and the studies of floatability of coal-pyrite and the effect of various parameters such as grinding media and environment, aging under different atmospheres, etc. on thereof, are directed at identifying the causes and possible solutions of the pyrite rejection problems in coal cleaning.

6121 (IS–5032) **Study of fine and ultrafine particles for coal cleaning: Fossil energy quarterly report, April 1, 1990–June 30, 1990.** Birlingmair, D.; Buttermore, W.; Enustun, V.; Pollard, J. Ames Lab., IA (United States). Jul 1990. 18p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-7405-ENG-82. Order Number DE92005173. Source: OSTI; NTIS; GPO Dep.

The primary objective of this research is to identify improved means for predicting the cleanability of fine and ultrafine coal by investigating the phenomena which govern laboratory techniques used to separate coal ground to find and ultrafine sizes for the determination of washability characteristics. This study seeks to identify and quantify factors other than gravity which affect separation, to establish limitations of density-based separation, and to develop techniques which will provide more accurate and consistent prediction of cleanability.

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Refer also to citation(s) 6107, 6113, 6208, 6209, 6210, 6216, 6218, 6220, 6226, 6234, 6506, 6551, 6555, 7178, 7641

6122 (CONF-910571–, pp. 216-229) **Upgrading of low rank coal to carbon products.** Heng, S. (Coal Corp. of Victoria, Churchill (Australia)); Perry, G.J.; Allardice, D.J. North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. [1991]. From 16. biennal low-rank fuels symposium; Billings, MT (United States); 20-23 May 1991. In *Proceedings of the sixteenth biennial low-rank fuels symposium.* 535p. Order Number DE92002606. Source: OSTI; NTIS; INIS.

Victorian brown coal has an inherently low mineral matter content which makes it particularly attractive as a feedstock for the production of industrial carbons. Over the last decade, this vast resource of low rank coal has been extensively studied for its potential in the production of activated carbon, anode carbon, metallurgical reductant and other value added carbons. The chemical and physical characteristics of these carbon products are highly specific placing stringent conditions on the processes needed to upgrade the coal to carbon products. The methods used in modifying brown coal properties such as porosity, density and physical hardness to produce the various carbon products are discussed.

6123 (CONF-910571–, pp. 247-255) **Wilsonville Hot Gas Cleanup Test Facility.** Sears, R.E. (Southern Co. Services, Inc., Birmingham, AL (United States)); Gallaspy, D.T. North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. [1991]. From 16. biennal low-rank fuels symposium; Billings, MT (United States); 20-23 May 1991. In *Proceedings of the sixteenth biennial low-rank fuels symposium.* 535p. Order Number DE92002606. Source: OSTI; NTIS; INIS.

Integrated gasification combined cycle (IGCC) has the potential to produce power in a cleaner and more efficient manner than conventional pulverized-coal fired units with flue gas desulfurization. The ability to clean the gas hot could reduce the cost of electricity by 10 to 15 percent. However, one of the main obstacles to utilizing these systems is the removal of hot particulates from the gas stream. In September of 1990 Southern Company Services (SCS) entered into an agreement with the Department of Energy to design, construct and operate a test facility to evaluate the long term performance of high temperature particulate control devices. The facility will be sized to handle 50 tons/day of coal feed, utilizing both bituminous and subbituminous coals, and will be located at SCS's pilot facilities in Wilsonville, Alabama. The gas generator for the facility will be based on M.W. Kellogg's transport reactor concept and will be operated in both pressurized gasification and combustion modes at temperatures and pressures up to 1,880F and 300 psig. The design of the facility is expected to be completed by the fall of 1992 with the target to have the facility operational by the first of 1994.

6124 (CONF-910571–, pp. 301-320) **High-pressure gasification of Montana subbituminous coal.** Goyal, A. (Inst. of Gas Technology, Chicago, IL (United States)); Bryan, B.; Rehmat, A. North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. [1991]. From 16. biennal low-rank fuels symposium; Billings, MT (United States); 20-23 May 1991. In *Proceedings of the sixteenth biennial low-rank fuels symposium.* 535p. Order Number DE92002606. Source: OSTI; NTIS; INIS.

A data base for the fluidized-bed gasification of different coals at elevated pressures has been developed at the Institute of Gas Technology (IGT) with different ranks of coal at pressures up to 450 psig and at temperatures dictated by the individual coals. Adequate data have been obtained to characterize the effect of pressure on the gasification of Montana Rosebud subbituminous coal and North Dakota lignite. The results obtained with Montana Rosebud subbituminous coal are presented here.

6125 (CONF-910571–, pp. 321-341) **Process development of mild gasification for midwestern bituminous and western low-rank coals.** Aulich, T.R. (Univ. of North Dakota, Grand Forks (United States)); Ness, R.O.; Sharp, L. North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. [1991]. From 16. biennal low-rank fuels symposium; Billings, MT (United States); 20-23 May 1991. In *Proceedings of the sixteenth biennial low-rank fuels symposium.* 535p. Order Number DE92002606. Source: OSTI; NTIS; INIS.

Development of the Energy and Environmental Research Center (EERC)/AMAX mild gasification process is progressing, using a 100-lb/hr process development unit (PDU) with a high-sulfur midwestern bituminous coal and a low-rank, low-sulfur western coal. This process development effort, one of four sponsored by the Department of Energy, is targeted to produce metallurgical coke substitutes, carbon black, activated carbon, diesel fuel additives, chemical feedstock materials, and pure chemicals. Work completed includes a market assessment, a process literature survey, 1-lb/hr bench-scale tests, and 100-lb/hr PDU tests. Technical and economic evaluation of these results is currently being completed, as is the cost estimation of a 1-ton/hr pilot plant. The PDU consists of a fast fluidized-bed carbonizer optimized for condensable production and a bubbling fluidized-bed calciner to reduce volatile and sulfur contents to acceptable levels for metallurgical coke production. Condensables are collected in three unit operations: a high-temperature tar venturi scrubber, a sieve tower, and a water venturi scrubber. Chars produced at 1,100F have ranged in volatile content from 15% for the subbituminous coal to 13% for the bituminous coal. Ash contents were 10% and 19%, respectively, for the subbituminous and bituminous coal chars, while sulfur contents were 0.4% and 3%, respectively. Three distinct boiling point fractions of liquids were collected from the condensation train. With subbituminous coal, the tar scrubber yielded liquids ranging in boiling point from 380-500C, the sieve tower liquids ranged from 200-470C, and the water scrubber liquids ranged from 170-440C. With the bituminous coal, the tar scrubber yielded liquids ranging in boiling point from 400-510C, and the combined sieve tower/water scrubber liquids ranged from 170-460C.

6126 (CONF-910571–, pp. 448-474) **The Charfuel coal refining process.** Meyer, L.G. (Carbon Fuels Corp., Englewood, CO (United States)). North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. [1991]. From 16. biennal low-rank fuels symposium; Billings, MT (United States); 20-23 May 1991. In *Proceedings of the sixteenth biennial low-rank fuels symposium.* 535p. Order Number DE92002606. Source: OSTI; NTIS; INIS.

The patented Charfuel coal refining process employs fluidized hydrocracking to produce char and liquid products from virtually all types of volatile-containing coals, including low rank coal and lignite. It is not gasification or liquefaction which require the addition of expensive oxygen or hydrogen or the use of extreme heat or pressure. It is not the German pyrolysis process that merely 'cooks' the coal, producing coke and tar-like liquids. Rather, the Charfuel coal refining process involves thermal hydrocracking which results in the rearrangement of hydrogen within the coal molecule to produce a slate of co-products. In the Charfuel process, pulverized coal is rapidly heated in a reducing atmosphere in the presence of internally generated process hydrogen. This hydrogen rearrangement allows refinement of various ranks of coals to produce a pipeline transportable, slurry-type, environmentally clean boiler fuel and a slate of value-added traditional fuel and chemical feedstock co-products. Using coal and oxygen as the only feedstocks, the Charfuel hydrocracking technology economically removes much of the fuel nitrogen, sulfur, and potential air toxics (such as chlorine, mercury, beryllium, etc.) from the coal, resulting in a high heating value, clean burning fuel which can increase power plant efficiency while reducing operating costs. The paper describes the process, its thermal efficiency, its use in power plants, its pipeline transport, co-products, environmental and energy benefits, and economics.

6127 (CONF-910571–, pp. 475-488) **The Liquids From Coal mild gasification process: Handling and combustion properties of the solid process derived fuel.** McCord, T.G. (ENCOAL Corp., Houston, TX (United States)); Siddoway, M.A.; Farmayan, W.F. North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. [1991]. From 16. biennal low-rank fuels symposium; Billings, MT (United States); 20-23 May 1991. In *Proceedings of the sixteenth biennial low-rank fuels symposium.* 535p. Order Number DE92002606. Source: OSTI; NTIS; INIS.

The Liquids From Coal (LFC) process produces two new fuels, a liquid and a solid, that will be low sulfur alternatives. Handling, storage, combustion and ash utilization properties of the solid fuel, produced by applying the LFC Process to Powder River Basin coal, are described. Based on these properties, a Demonstration Plant is under construction at the Buckskin Mine in Wyoming.

6128 (CONF-9106303–, pp. 18-19) **Chemistry of coal-related microparticles.** Davis, E.J. (Univ. of Washington, Seattle (United States)); Krieger-Brockett, B. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-89PC89790. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objective is to develop and apply novel single microparticle techniques to perform simultaneously thermogravimetric analysis and Raman/fluorescence spectroscopies on microparticles of coal (macerals) and sorbents (CaO) used for coal desulfurization. The combination electrodynamic balance/spectrometer system will be used to chemically characterize macerals from different ranks of coal and to explore the chemistry and chemical reaction rates associated with processes involving such microparticles. Rate processes will be examined at elevated temperatures by heating the particles electromagnetically. Measuring instruments, methods, and materials are described. Results to date are discussed.

6129 (CONF-9106303–, pp. 53-55) **Bioprocessing of lignite coals using reductive microorganisms.** Crawford, D.L. (Univ. of Idaho, Moscow (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-88PC88919. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

A number of aerobic bacteria, anaerobic bacteria, and anaerobic bacterial consortia capable of transforming lignite coals were isolated and characterized. The anaerobes carry out numerous reductive transformations of coal substructure model compounds. Transformations include decarboxylations, demethylations, dehydroxylations, and reduction of carbonyl groups and carbon-carbon double bonds. A number of aerobic, lignite coal-depolymerizing bacteria have been isolated. These strains depolymerize coal without significantly oxidizing it. Three selected strains have been shown to produce extracellular coal depolymerizing enzyme activities. Crude enzyme preparations from culture supernatants of these strains will substantially reduce the average molecular weight of a water soluble lignite coal polymer over incubation periods of 2-4 hours at 30-35C. Recent research shows that the enzymes involved may include extracellular peroxidases, esterases, and/or etherases. The authors are the first to report the production by bacterial of extracellular enzymes that catalyze the depolymerization of a macromolecular coal polymer. They have evidence that indicates that three different types of enzymes, including peroxidases, esterases, and etherases, may be involved in the depolymerization process. They have also isolated a number of strictly anaerobic bacteria which catalyze potentially useful reductive transformations of coal substructure model compounds. Methods are being developed to monitor and quantify these reductive biotransformations using lignite when coals as substrates.

6130 (CONF-9106303–, pp. 56-58) **Electrochemistry of Thiobacillus ferrooxidans reactions with pyrite.** Pesic, B. (Univ. of Idaho, Moscow (United States)); Oliver, D.J. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-88PC88920. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

A detailed cyclic voltametry study was performed on mineral pyrite. The following parameters were studied: effect of turbulence, scanning rates, and effect of nutrient addition. Two types of pyrite electrodes were used, which were characterized according to their use. One pyrite electrode was continuously present during fermentation and the other electrode was used as a control electrode. The key feature of the research was the study of pyrite interaction with T. ferrooxidans during their most active stage, i.e. growth. This kind of work was never performed before. Very important results were obtained. According to the obtained results, pyrite surface becomes quickly covered with T. ferrooxidans (within 2 days) which completely isolates the pyrite surface from the solution. The obtained cyclic voltametric data were also correlated with the SEM study. The reaction product which was responsible for pyrite passivation was characterized chemically and by X-ray diffraction. The chemical analysis showed its chemical composition very close to jarosite.

6131 (CONF-9106303–, pp. 61-62) **Bimetallic promotion of cooperative hydrogen transfer and heteroatom removal in coal liquefaction.** Eisch, J.J. (State Univ. of New York, Binghamton (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-88PC88930. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The ultimate objective of this research is to uncover new catalytic processes for the liquefaction of coal and for ungrading coal-derived fuels by removing undesirable organosulfur, organonitrogen and organooxygen constituents. Basic to both the liquefaction of coal and the purification of coal liquids is the transfer of hydrogen from such sources as dihydrogen, metal hydrides or partially reduced aromatic hydrocarbons to the extensive aromatic rings in coal itself or to aromatic sulfides, amines or ethers. Accordingly, this study is exploring how such crucial hydrogen-transfer processes might be catalyzed by soluble, low-valent transition metal complexes and/or Lewis acids under moderate conditions of temperature and pressure. In individual studies the catalytic potential of various Lewis acids in effecting hydrogen transfer from hydrogen donors to aromatic hydrocarbons, sulfides, ethers and amines has been evaluated. In parallel studies the corresponding catalytic potential of soluble nickel(O) complexes for such hydrogen transfers has also been evaluated. Now in the present work the author is concentrating on the possible synergistic action of combinations of Lewis acids with nickel(O) complexes in hydrogen transfer tht can lead to reduction of carbon-carbon unsaturation and the rupture of carbon-heteroatom bonds. At this point they have concluded that there is a synergistic action of these catalyst combinations and that desulfurization, deoxygenation and possibly denitrogenation can be promoted by these bimetallic catalysts.

6132 (CONF-9106303–, pp. 63-64) **Fundamental studies in production of C_2-C_4 hydrocarbons from coal.** Wiser, W.H. (Univ. of Utah, Salt Lake City (United States)); Oblad, A.G. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-88PC88940. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The project objectives are to demonstrate, in a specially-designed, continuous-flow reactor system, direct conversion of coal to C_2, C_3 and C_4 hydrocarbons; to examine the kinetics of the conversion process; and to gain understanding of the reaction pathways. A computer program will be developed to define the maximum yields of C_2, C_3, and C_4 hydrocarbons (individually) thermodynamically possible as a function of temperature, pressure, and percent steam in the steam-hydrogen feed to the reactor. The process will then be optimized for production of each of the hydrocarbons C_2, C_3 and C_4, and for production of olefins among these hydrocarbons.

6133 (CONF-9106303–, pp. 65-66) **Applications of micellar enzymology to clean coal technology.** Walsh, C.T. (Boston Univ., MA (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-89PC89772. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The principle objective of this project is to investigate the technology of reverse micelle enzyme biochemistry in the desulfurization of model coal compounds and coal samples. The goal is to develop micellar systems that enhance enzyme-mediated oxidation of organic sulfur and its removal from organic substrates with minimum cleavage of carbon-carbon bonds. Model compounds in this study include dibenzothiophene (DBT) and ethylphenylsulfide (EPS). The primary emphasis is the investigation of isolated enzymes in micellar systems including horseradish peroxidase (HRP), chloroperoxidase, and laccase; microbial extracts are under study as well. Analytical methodology for quantitation of DBT, EPS and their sulfur oxidation products in reverse micelle solutions have been developed. The oxidative activity of HRP and laccase in the reverse micelle system has been demonstrated using conventional substrates. Tests of these enzymes in reverse micelles, as well as a microbial extract, have not indicated efficacy in oxidation of sulfur in DBT under conditions of study.

6134 (CONF-9106303–, pp. 67-68) **Mechanism of hydrodenitrogenation.** Miranda, R. (Univ. of Louisville, KY (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-89PC89771. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts* *and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The general objective of this project is to clarify the extent of participation of support acidity and catalyst acidity in general in the mechanistic steps leading to denitrogenation of hetero-aromatics. In particular, it is of interest to prove or disprove a bifunctional mechanism in which the acidic functionality catalyzes a Hofmann-like elimination step; to investigate which secondary reactions are catalyzed by acidity; and to qualify and quantify the effect of acidity on surface structure of Mo species. The particular objectives during this past year were (a) to continue with the characterization of the acidic catalysts developed in this project: molybdena supported on silica-aluminas of varying composition, and (b) to investigate the role of acidic sites by means of the piperidine HDN reaction. Details are given of the work done to date and results are discussed. To date the researchers have: (a) developed a complete series of silica-aluminas of varying composition and acidity characteristics; (b) developed a method to analyze (on-line) all of the products of piperidine denitrogenation reaction; and (c) showed the role of each type of acidity in the mechanism of piperidine denitrogenation and overall reaction.

6135 (CONF-9106303–, pp. 69-70) **Fundamental studies of catalytic processing of synthetic liquids.** Watson, P.R. (Oregon State Univ., Corvallis (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-89PC89783. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

This project investigates, using surface science techniques, the reactions of simple furans and phenols, acting as models for the O-heterocycles found in coal liquids, at designed surface sites on sulfided Mo and W surfaces. The objectives of the study are to elucidate the changes in the mode of adsorption, reactions and poisoning behavior, with particular attention to dehydrodeoxygenation (HDO), of normal and sterically-hindered heterocycles at various well-defined catalytic centers designed to have different chemical characteristics. The author has discovered how to reliably obtain and has characterized the adsorption/reaction sites on sulfided Mo(100) and (110) surfaces using Auger electron spectroscopy (AES) and low energy-electron diffraction (LEED). Above a S/Mo ratio of about 0.6 ML, furan does not adsorb on these surfaces. As the sulfur coverage is lowered increasing amounts of furan can be adsorbed, but temperature-programmed reaction spectroscopy (TPRS) reveals that decomposition occurs. The major products of adsorption are molecular CO and strongly chemisorbed hydrocarbon fragments that dehydrogenate over a range of temperatures. Performing the adsorption or thermal reaction in 10^{-6} torr of hydrogen does not change the mode of reaction significantly.

6136 (CONF-9106303–, pp. 71-74) **Preconversion catalytic deoxygenation of phenolic functional groups.** Kubiak, C.P. (Purdue Univ., West Lafayette, IN (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-89PC89770. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objective is to prepare new catalysts for the deoxygenation of phenolic functional groups using carbon monoxide as the oxygen atom acceptor. The deoxygenation of phenols is a conceptually simple, but unusually difficult chemical transformation of importance in coal liquefaction. Present catalysts for removal of phenolic oxygen atoms are based on hydrodeoxygenation (HDO) methods. Typical HDO catalysts require high temperatures and H_2 pressures and lack selectivity. The author is studying the deoxygenation of phenols via the unprecedented use of the CO/CO_2 couple. Results to date are discussed.

6137 (CONF-9106303–, pp. 75-76) **Reactivity of young chars via energetic distribution measurements.** Calo, J.M. (Brown Univ., Providence, RI (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-90PC90307. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objective of this project is to apply recently developed techniques to the prediction/correlation of the reactivity of 'young' chars, as producted from 'mild gasification' processes, for example. The principal thrust of the project is concerned with the quantitative mapping of the reactivity behavior of coal chars, as revealed by the energetic heterogeneity of carbon-oxygen surface complexes, with char preparation conditions; i.e., heating rate and ultimate temperature. The energetic distributions of oxygen surface complexes produced by carbon dioxide, steam, and oxygen will be determined from thermal desorption spectra obtained by temperature programmed desorption/mass spectrometry (TPD/MS), using techniques that have been developed in the author's laboratory for these purposes. The apparatus has been moved to a new laboratory and has been rebuilt. A new mass spectrometer has been acquired and interfaced with the TPD reactor. The effect of CO_2 partial pressure on subsequent TPD spectra has been examined in a scoping study involving a Wyodak coal char and a resin char. The effects of the 'inert,' diluent gases, Ar, N_2, and He, on char reactivity have been examined in a scoping study.

6138 (CONF-9106303–, pp. 79-81) **Design of a high activity and selectivity alcohol catalyst.** Foley, H.C. (Univ. of Delaware, Newark (United States)); Mills, G.A. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objective of this reasearch is to design a new alumina-supported bimetallic catalyst, containing molybdena and a second reduced metal like rhodium, for the selective reduction of carbon monoxide to methanol and higher alchols. It is paramount that a thorough understanding of the respective roles of rhodium and molybdenum be established in terms of the kinetics of reduction, as well as the chemical and physical states of the metals. The experimental facilities that are required to do this research have been designed and constructed during this first year. These include the installation of a Schlenk line for anaerobic catalyst synthesis, the redesign of the high pressure reactor, the design and construction of a low pressure reactor, and the design and construction of a volumetric chemisorption unit and a C.I. electrobalance. Work is underway to examine the secondary acid dehydration of primary product alcohols and to determine compositional effects on metals dispersion.

6139 (CONF-9106303–, pp. 82-83) **Catalysis and cocatalysis of bond cleavages in coal and coal analogs.** Miller, B. (Univ. of Massachusetts, Amherst (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-90PC90298. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objective is to elucidate mechanisms for transfer hydrogenolysis and catalysis of hydrogenolysis of aryl-heteroatom and aryl-carbon bonds, and to develop more effective, inexpensive catalysts for coal conversion. Products from thermolysis of 9-substituted anthracenes in tetralin, including a product resulting from incorporation of solvent at C-9 positions of the anthracenes, have been identified. The first examples of catalysis of transfer hydrogenolysis of aryl-heteroatom bonds by aromatic polyethers in the absence of hydrogen bonding agents have been observed.

6140 (CONF-9106303–, pp. 84-85) **Probe molecule studies: Active species in alcohol synthesis.** Blackmond, D.G.

(Univ. of Pittsburgh, PA (United States)); Wender, I. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-90PC90305. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objective of this work is to study the in-situ addition of probe molecules to CO hydrogenation reactions for the formation of alcohols. The incorporation of these probe molecules, which include nitromethane and substituted acetylenes, into the reaction network promises to provide important information about the mechanisms of alcohol formation. The first half year of the project has been devoted to building a high pressure reaction system with a liquid syringe pump for addition of the probe molecules. Analytical systems for identifying and quantifying products have also been set up and tested, including a GC-MS system with dual capillary and packed columns for separation and analysis of hydrocarbon and oxygenate products. Experiments are currently being carried out with a Cu/ZnO catalyst under methanol-producing conditions.

6141 (CONF-9106303–, pp. 86-87) **Biotic and abiotic carbon to sulfur bond cleavage.** Frost, J.W. (Purdue Univ., West Lafayette, IN (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-90PC90294. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

Mechanisms exploited by microbes to cleave carbon to sulfur (C-S) bonds in organosulfur molecules are to be delineated. Chemical mimics of these biotic processes are then to be elaborated. The ability of Escherichia coli to use organosulfonic acids as a sole source of sulfur during growth has been established. This degradative system possessed by E. coli will cleave virtually any organosulfonate C-S bond as long as there is one methylene adjacent to the sulfonic acid. Degradation results in products where the sulfonic acid is replaced by an alcohol. Based on deuterium labelling experiments, the mechanisms responsible for this biotic C-S bond cleavage involves an intermediate α-hydroxyorganosulfonate. An alternate formulation involving direct insertion of oxygen between the carbon and sulfur atoms of the sulfonic acid is not consistent with the deuterium labelling experiments. Results to date are discussed.

6142 (CONF-9106303–, pp. 90-91) **Advanced, soluble hydroliquefaction and hydrotreating catalysts.** Laine, R.M. (Univ. of Washington, Seattle (United States)); Stoebe, T. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-90PC90313. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

Previous work in this group has shown that, surface confined, organometallic catalysts are exceptionally effective for hydrogenation and HDN of coal model compounds such as quinoline. Unfortunately, surface confined catalysts have not proven to be particularly effective when used with coal itself. The problem derives from the fact that: (1) liquefaction is a solid (catalyst)-liquid (coal polymer) reaction system where, (2) diffusion of coal bonds to the heterogeneous catalyst surface is mass transport limited and controls liquefaction rates. Furthermore, heterogeneous catalyst mediated liquefaction is surface area dependent, placing another constraint on reaction rates. The purpose of the present program is to develop soluble analogs of surface confined catalysts that can be impregnated directly into the coal structure at low temperatures. Heteropolyanions (HPAs) offer the opportunity to develop soluble forms of surface confined catalysts. HPAs, are inexpensive, well-characterized, water soluble metal oxide clusters, e.g. $[EM_{12}O_{40}]^{4-}$ where E = Si or P and M = Mo or W. They are easily modified to contain other transition metals such as Co, Ni or Ru and, can be made soluble in organic solvents. The protic forms exhibit extremely high acidities $pK_a \approx 0$-2. In addition, selectively modified HPAs can function as low temperature hydrogenation catalysts that exhibit microporosity. HPAs are multi-functional catalysts that could be used to promote both hydroliquefaction and hydrotreating. The program consists of three major tasks: (1) preparation of candidate HPA precatalysts; (2) HDN and HDO modeling studies and (3) direct liquefaction studies. Work to date is discussed.

6143 (CONF-9106303–, pp. 92-93) **Steam gasification of carbon: Catalyst properties.** Falconer, J.L. (Univ. of Colorado, Boulder (United States)); Lauderback, L.L. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-88PC88915. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objective is to determine the catalyst composition and concentration for metal oxide catalyzed gasification of carbon. This involves measuring the concentration of active catalytic sites at reaction conditions, the composition of the catalyst, and the site-specific rate constant. This information will provide insight into the reaction mechanism and how to maximize catalyst dispersion. Most of the experimental efforts during the last year have been devoted to transient studies of gasification. A series of experiments with various catalyst loadings and at various temperatures were carried out. They identified modifications that were required to obtain accurate and reproducible data. Major modifications were made to the transient reaction system as a result of these experiments. The delay times were decreased dramatically from 26 sec to 2.6 sec, after an extensive experimental study to identify limiting factors. These modifications have allowed the system to be put into full operation and another series of experiments were carried out on $K_2CO_3/^{13}C$ mixtures using CO_2 to gasify the mixture. Based on these experiments, modifications in the sample preparation were required, and with this new preparation procedure, reproducible results were obtained. An isopropanol/water solution was found to be effective for dissolving K_2CO_3 and wetting carbon.

6144 (CONF-9106303–, pp. 94-96) **Alkali/TX_2 catalysts for CO/H_2 conversion to C_1-C_4 alcohols.** Klier, K. (Lehigh Univ., Bethlehem, PA (United States)); Herman, R.G. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-88PC88933. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objective is to investigate and develop novel sulfur-tolerant catalysts for the conversion of coal-derived synthesis gas into C_1-C_4 alcohols by a highly selective process. Therefore, the variations of catalyst activity and selectivity for the synthesis of alcohols from $H_2/CO \leq 1$ synthesis gas for a series of A/TX_2 compounds, where A is a surface alkali dopant, T is a transition metal, and X is S is being determined. The preparation, catalytic testing, and characterization of MoS_2, RuS_2, and NbS_2 catalysts has been accomplished. Both stoichiometric and nonstoichiometric TX_2 compounds have been examined. Under the reaction conditions employed to-date, the Cs/MoS_2 catalyst exhibits the highest activities and selectivities toward the synthesis of oxygenates. The HR-ESCA surface analyses of the catalysts using the SCIENTA-300 ESCA has demonstrated that useful chemical information is provided, especially from the valence band spectral region. For example, the MoS_2 band structure is well-developed for particles as small as 6 nm, but distinct differences are noted when compared with the spectrum obtained from single crystal MoS_2, e.g. states appear in the dispersed sulfide above the top of the valence band of the single crystal MoS_2, and these might be reflected in catalytic behavior. The thermodynamic stabilities of the TS_2 catalysts against loss of sulfur in a reducing environment have been calculated, and it is shown that MoS_2 and NbS_2 should be stable without H_2S being present in the synthesis gas.

6145 (CONF-9106303–, pp. 97-98) **Inhibition of retrogressive reactions in coal/petroleum co-processing.** Schobert, H.H. (Pennsylvania State Univ., University Park (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-88PC88935. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objective of this project is to develop a fundamental understanding of the reactions occurring at the onset of coke formation during the co-processing of coals with petroleum residua. The knowledge of pathways to coke formation would allow the selection of appropriate coal/petroleum feedstock combinations and processing conditions to minimize or eliminate coke formation. Specific objectives include examination of chemical components on retardation of enhancement of coke formation. Set of five coals have been reacted with a set of five model compounds representative of components of heavy petroleum fractions. The model compounds range from purely aliphatic, eicosane, through alkylated aromatics to purely aroamtic, pyrene. The coals were also reacted with three petroleum resids. Mass transfer and mixing effects were evaluated compring data from reactions conducted in vertical vs. horizontal agitated microautoclave reactors. Three reaction temperatures and two gas atmospheres were used in all of the reactions. The yield of tetrahydrofuran (THF) insolubles is the lowest in the presence of pyrene. The values obtained for reaction with coal/eicosane and coal/1-phenyldodecane are very close to eacy other, as well as are the ones for coal in reaction with 1,4-diisoprolylbenzene and durene. The yields for THF-insolubles in the reactions with the petroleum resids at 400C are in the range of the values obtained with pyrene. At the lower reaction temperature (350C) the petroleum resids did not act as 'good' solvents in terms of enhancing coal conversion while the results from the reactions at 450C indicated the presence of retrogressive reactions, the coal conversion having negative values. The effect of the reaction temperature is in addition related to the fluidity of the coal. The optimum temperatures for coal conversion seem to coincide with the maximum fluidity temperature of the coal.

6146 (CONF-9106303–, pp. 99-101) **Novel supports for coal liquefaction catalysts.** Haynes, H.W. Jr. (Univ. of Wyoming, Laramie (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-88PC88942. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objectives of this research are first to construct a Catalytic Coal Liquefaction Microreactor (CCLM) and then to use this unit to screen catalysts prepared from novel and/or modified supports for coal liquefaction applications. Run lengths will be sufficient to give a measure of catalyst deactivation rate. Modified supports will include aluminas treated with alkali and alkaline earth metals and halogens. Novel supports will include carbons, single component oxides and composite oxides. Efforts will be made to correlate coking tendency with catalyst acidity measurements. Shakedown operations of the CCLM during the past year have resulted in significant improvements to the unit. In addition, these runs have demonstrated that the novel ebullated bed microreactor provides an excellent means for evaluating hydrotreating kinetics. Heretofore this has not been possible in a unit of this size. A firm foundation has thus been laid for the next step of the program - the introduction of coal into the unit.

6147 (CONF-9106303–, pp. 25-26) **The effect of selective solvent absorption on coal conversion.** Larsen, J.W. (Lehigh Univ., Bethlehem, PA (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

This project has two objectives: (1) to determine the composition of the recycle solvent actually present within the coal during the early stages of direct liquefaction; (2) to determine the effect of the presence or absence of hydrogen donors within the coal during the early stages of coal conversion. The experimenal work to date has been directed solely at the first of the objectives listed above. An apparatus has been designed and constructed which allows the exposure of coals to Wilsonville recycle oil at temperatures between 120 and 180C at various solvent:coal ratios. Both Illinois No. 6 coal and Wyodak subbituminous coal have been so exposed. The coals do absorb solvent and swell. The amount of solvent absorbed increases with the exposure temperature. The proton NMR of the whole recycle oil and of the non-absorbed part of the recycle oil have been compared (Illinois No. 6 coal). The spectra are identical, in spite of the fact that the coal has absorbed between 15 and 23% of the recycle oil, depending on conditions. The molecular weight distributions of the recycle oil before and after a portion has been removed by absorption, are identical. The tentative conclusion is that, for this relatively non-polar recycle oil, no selective absorption by Illinois No. 6 coal is occurring.

6148 (CONF-9106303–, pp. 102-103) **Control of catalytic hydrotreating selectivity with ammonia.** Satterfield, C.N. (Massachusetts Inst. of Tech., Cambridge (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-89PC89775. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The author has discovered that the presence of a low concentration of ammonia can substantially reduce the rate of hydrogen uptake of an aromatic compound on an industrial $NiMo/Al_2O_3$ catalyst while under similar conditions it has only a mild inhibiting effect on hydrodenitrogenation (of quinoline). This suggests a method under industrial reaction conditions of minimizing undesired aromatic hydrogenation during catalytic hydrodenitrogenation and hydrotreating. He plans to explore this effect in more detail by model compound studies, with attention to their relevance to hydrotreating coal liquids. Studies have proceeded in two phases: First, the author observes that coal liquids contain substantial amounts of a base fraction that seems to consist of hydroxy pyridines, hydroxy indoles and/or hydroxy anilines. He first performed a limited hydrotreating study with 8-hydroxy quinoline (8 HQ) dissolved in tetralin utilizing a $NiMo/Al_2O_3$ catalyst in a packed bed reactor operating at 360C and 385C and 6.9 MPa. He finds that the HDN reaction of this compound proceeds by three routes to enter the quinoline reaction network. In the second, more recent phase, he has been studying the hydrotreatment of a mixture of quinoline and naphthalene. Quinoline was chosen as the model heterocyclic compound. Naphthalene was selected as the model aromatic hydrocarbon. In brief, he finds that added NH_3 has little effect on the hydrogenation rate of naphthalene, but a marked inhibiting effect on hydrogenation of tetralin. Thus selectivity is controlled in the direction of a partially hydrogenated aromatic product, which is desired for coal liquefaction. A kinetic model is being developed to summarize these results.

6149 (CONF-9106303–, pp. 104-105) **Enhanced coal hydrogasification via oxidative pretreatment.** Miller, D.J. (Michigan State Univ., East Lansing (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-89PC89777. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

Enhancement of coal hydrogasification rate via oxidative treatments is investigated with the objective of developing optimal oxidation methods and conditions to maximize conversion rate. Emphasis is placed on characterizing surface oxygen groups, which are responsible for the active sites for gasification, and on fundamental aspects of the carbon-hydrogen reaction, including catalysis and rate inhibition. Methods and materials are described and results are discussed. Three-fold hydrogasification rate enhancements were observed following oxidation of partially gasified coal and Saran char. Similar results were obtained for outgassed chars. Moderate rate enhancements (50-100%) were observed following oxidation of partially gasified chars impregnated with K_2CO_3 catalyst. Results indicate that oxygen groups desorb during heatup to provide reactive sites at which hydrogasification occurs; oxygen chemisorption measurements indicate more active sites following oxidation of the char surfaces. Hydrogasification rate is correlated with oxygen chemisorption.

6150 (CONF-9106303–, pp. 111-112) **Novel reactor configuration for syngas conversion to alcohols.** Akgerman, A. (Texas A and M Research Foundation, College Station (United States)); Anthony, R.G. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-89PC89787. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objective if this research is to develop a new, efficient reactor configuration and process for the synthesis of methanol and higher alcohols from coal gasification products. Preliminary work has shown that a trickle bed reactor with a mineral oil flowing cocurrently with the gas feed down the reactor over a fixed bed of catalyst is more efficient than existing gas phase and slurry reactors. The authors will determine the effects of temperature, space velocity, synthesis gas/mineral oil feed ratio, and $H_2/CO/CO_2$ ratio on conversion and product distribution in a small laboratory trickle bed reactor; determine the intrinsic kinetics of the reaction in a slurry reactor; optimize and design a pilot size trickle bed unit; simulate the performance of this unit; and compare the performance in terms of yield and selectivity to slurry reactors. They have developed a model for the trickle bed reactor that takes into account gas and liquid phase hydrodynamics, mass transfer between the two phase together with vapor liquid equilibrium at the interface, mass transfer into catalyst particle, effective diffusion rates, partial wettingof the catalyst particle, wetted and dry regions in the bed, and the reaction kinetics. They started determining the reaction kinetics in a slurry reactor that operates in the perfectly mixed mode with well defined hydrodynamics. Various kinetic model equations in the literature are simulated at typical operating conditions to determine how well they agree with each other and they run experiments at points of maximum discrepancy between the various models. This approach reduces the total number of experiments significantly.

6151 (CONF-9106303–, pp. 113-114) **Novel process for depolymerization of coal to C_2-C_4 hydrocarbons.** Wiser, W.H. (Univ. of Utah, Salt Lake City (United States)); Oblad, A.G. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-89PC89788. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The overall project objective is to design, construct and operate a continuous-flow reactor system for direct catalytic depolymerization of coal to produce C_2-C_4 hydrocarbons, which reactor may serve as a prototype for scale-up. To aid in achieving that overall objective, a companion research project is to provide kinetic data to assist in the design. Any products removed in the liquid state from the reactor system of the companion project will be characterized, including evaluation of any hydrogen-donor capability. A special reactor has been designed and constructed, incorporating quartz glass windows for visual observation, in which the operation of a catalyst bed fluidized by super-critical, coal-derived fluids will be examined. The capability of a coal-derived, hydrogen-donor fluid, in the super-critical state, to control agglomeration of a strongly caking coal, in the catalyst bed, will be evaluated. Finally, a continuous reactor system intended to serve as a prototype for scale-up will be designed, constructed and operated.

6152 (CONF-9106303–, pp. 115-116) **Mild coal pretreatment to improve liquefaction reactivity.** Miller, R.L. (Colorado School of Mines, Golden (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-90PC90289. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

This project continues the research program at CSM to develop an advanced low severity coal liquefaction scheme using mild chemical pretreatment of the coal to enhance coal dissolution reactivity. The process consists of three main steps: (1) mild pretreatment of the feed coal at ambient temperature and pressure using methanol or other common organic solvent with a trace amount of hydrochloric acid (or other common acid) to enhance dissolution reactivity and dry the coal, (2) low severity thermal dissolution of the treated coal to obtain a very reactive coal-derived residual material amenable to upgrading, and (3) catalytic upgrading of the residual products to distillate liquids. The objective of the present project is to perform the necessary experimental work and data analysis to acquire and understand, from a more fundamental physicochemical basis, the following detailed information related to mild chemical pretreatment of coal: types and extent of coal bond cleavage during pretreatment and subsequent low severity thermal dissolution; effect of pretreatment on the coal's physical structure including surface are modifications; relationships between bond cleavage, metal chloride formation, coal conversion kinetics, and liquid and gaseous yields; liquid and residuum product characterization, including residuum reactivity towards catalytic or thermal upgrading to distillate liquid products.

6153 (CONF-9106303–, pp. 117-118) **Rapid pressure swing absorption cleanup of post-shift reactor synthesis gas.** Sirkar, K.K. (Stevens Inst. of Tech., Hoboken, NJ (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-90PC90300. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

This investigation is concerned with the separation of gas mixtures using a novel concept of rapid pressure swing absorption (RAPSAB) of gas in a stationary absorbent liquid through gas-liquid interfaces immobilized in the pore mouths of hydrophobic microporous membranes. The process is implemented in a module well-packed with hydrophobic microporous hollow fiber membranes. The specific objectives are (1) to develop a theoretical model which will provide guidelines for selecting an efficient RAPSAB process cycle which includes desorption; (2) to demonstrate the concept experimentally with a simple gas mixture (e.g., CO_2-N_2) and a simple absorbent liquid such as water, and (3) to extend the concept to reactive absorbent liquids for the separation of CO, CO_2 from the post-shift reactor synthesis gas. A simplified theoretical description of the novel rapid pressure swing absorption process has been developed. The absorption part of the pressure swing absorption cycle has been predicted for CO_2-N_2-water system. Numerical simulation of the model is being carried out for different operating conditions for selecting an optimum pressure swing cycle.

6154 (CONF-9106303–, pp. 123-125) **Supercritical fluid thermodynamics for coal processing.** van Swol, F. (Univ. of Illinois, Urbana (United States)); Eckert, C.A. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-88PC88922. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United

States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

Because of their unusual solvating and mass transfer properties, supercritical fluids (SCF) show potential for a variety of coal processing applications. The main objective of this research is to develop a predictive equation of state so that SCF solvents can be tailored for the extraction and processing of coal. To meet this objective, the authors are carrying out a two pronged approach. First, a database containing the solubilities of coal model compounds in high temperature fluids, polar fluids, and fluid mixtures has been collected and is being extended. Second, they are looking at the intermolecular interactions between the solute and the solvent, cosolvent, and other solute molecules using spectroscopic techniques. All this information gives them the means to develop an equation of state that accurately reflects the true molecular makeup of the solution.

6155 (CONF-9106303–, pp. 130-131) **Novel coal feeder for low-sulfur fuel.** Soonjai Khang (Univ. of Cincinnati, OH (United States)); Keener, T.C. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The project objective is to study the feasibility of an advanced coal desulfurization concept in a coal feeder. It is proposed to construct a novel coal feeder which contains dual screw tubes, the inner tube acting as a coal pyrolizer and the outer tube acting as a desulfurizer with hot calcined limestone pellets or other renewable sorbent pellets. The inner screw feeder pyrolyses coal particles in a reducing environment which produces sulfur-containing gases such as H_2S and COS. Hot calcined limestone pellets (or other renewable sorbent pellets) are added to the outer tube and react with sulfur components. Based on the experimental data on both the pyrolysis and the limestone-based desulfurization, the proposed system is expected to remove between 50 and 80% sulfur from various high-sulfur coals. Works under progress are (1) literature review on coal pyrolysis, (2) computer/math modeling of the pyrolysis section, (3) evaluation of pyrolysis kinetics, (4) experimental pyrolysis in an auger feed tube. The conclusions are: (1) pseudo-component approach for the pyrolysis kinetics, (2) a 48% desulfurization was achieved at residence times of 7 minutes for a pyrolysis temperature of 450C, indicating a reasonable expectation for the goal of the project.

6156 (CONF-9106303–, pp. 136) **Chemical kinetics and transport processes in supercritical fluid extraction of coal.** McCoy, B.J. (Univ. of California, Davis (United States)); Smith, J.M. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-90PC90288. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objective is to investigate the supercritical fluid extraction, both catalytic and noncatalytic, of hydrocarbons from coal. Continuous-flow extraction experiments have been conducted on Montana lignite and Illinois No. 6 coal with supercritical tert-butanol. The fraction extracted and the aromatic contentof the extract increased with temperature. Insight into the chemical nature of the extract, and the effect of solvent interaction with coal, was obtained by detailed GC-MS analysis of the extract, both liquid and gas. The results indicate that tert-butanol, a hydrogen donor solvent, enhances the thermal degradation of coal, and that higher conversion of supercritical extraction can be achieved with tert-butanol than with toluene under the same conditions.

6157 (CONF-9106303–, pp. 145-146) **Indirect electrolysis process for removal of pollutants from coal liquids.** Koval, C.A. (Univ. of Colorado, Boulder (United States)); Noble, R.D. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-88PC88916. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The authors are exploring a novel separation process for the removal of nonvolatile nitrogen and sulfur pollutants from coal liquids. The process involves the binding of the pollutants to metalloporphyrin carriers. The binding is reversed by electrochemical oxidation of the carrier and the active form of the carrier is regenerated by reductive electrolysis. The efficiency of the process is evaluated by investigating the removal of a representative set of pollutants from solutions of iso-octane. Separations involving individual pollutants and mixtures of pollutants will be examined. Mathematical models which utilize the physical properties that are relevant to the separation process have been developed. These models will be used to determine conditions that produce optimal separation efficiencies. Results are discussed on experimental studies with iron porphyrins and ion-exchange polymers, the development of mathematical models, and the investigation of redox polymers on electrodes.

6158 (CONF-9106303–, pp. 147-149) **Mechanistic and kinetic studies of high-temperature coal gas desulfurization sorbents.** Sarofim, A.F. (Massachusetts Inst. of Tech., Cambridge (United States)); Flytzani-Stephanopoulos, M. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-88PC88927. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objectives of this project are to: (1) carry out kinetic measurements of the reduction of Zn-Ti-O mixed oxides to determine the optimum sorbent in terms of composition and chemical phases which yield the desired resistance to zinc loss by reduction, (2) carry out kinetic measurements of the sulfidation reactions including intrinsic reaction rate and product layer diffusion measurements for both Zn-Ti-O and ZnO materials, and (3) determine structural changes and chemical phase transformations during sulfidation. Experimental methods are described and results and conclusions to date are summarized.

6159 (CONF-9106303–, pp. 181-182) **High-temperature membranes for H_2S and SO_2 separations.** Winnick, J. (Georgia Inst. of Tech., Atlanta (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-90PC90293. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objective is to develop a high temperature membrane separation technique which can be applied to gas mixtures involved in coal utilization. For coal gasification, H_2S is removed from the syn-gas stream, split into hydrogen, which enriches the syn-gas, and sulfur, which can be condensed from an inert gas sweep stream. For coal combustion, SO_2 is separated from the flue gas, with concentrated SO_3 produced as a by-product. Both processes appear economically viable, but each requires fundamental improvements: more efficient membranes and a more efficient anode for the H_2S cell. Particle size determinations led to initial optimization of ceramics loading in tape cast membranes. Coating of substrate material with polyethylene glycol solutions enhanced removal of the dried 'green' tapes. Highlights of results include the following for the SO_2 removal cell: identified possible replacement electrode material, lithiated NiO; increased current density from 1 mA/cm^2 to 5 mA/cm^2 (sustained) at 1.5 V cathodic overpotential; and reached 10 mA/cm^2 for short periods of time, but was limited by heating of inlet gas. Results include the following for the H_2S removal cell: used to polish natural gas streams with low concentrations of H_2S and prevented transport of H_2 from cathode to anode and subsequent oxidation of carbonate supporting electrolyte.

6160 (CONF-9106305–1) **Demonstration plant for IGCC using the U-GAS process.** Lau, F.S. (Institute of Gas Technology, Chicago, IL (United States)); Salo, K. Institute of Gas Technology, Chicago, IL (United States). [1991]. 18p. Sponsored by Institute of Gas Technology. From 18. world gas conference; Berlin (Germany); 24-28 Jun 1991. Source: OSTI; Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616.

Tampella, Ltd., in cooperation with the Institute of Gas Technology (IGT), is developing the gasification technology for U-GAS® to produce electricity from coal using the integrated gasification combined-cycle (IGCC). The concept of IGCC is to join the clean burning gasification island with a more efficient gas and stream turbine island to produce electric power with minimal environmental impact. IGT has developed the U-GAS process to produce a low- or medium-Btu gas from different types of coal feedstocks. The process uses a combination of fluidized=bed gasification and ash agglomeration in a single-stage reactor. A 30-tons/day-capacity pilot plant located in Chicago has been used to develop the process. Feedstocks ranging from relatively unreactive metallurgical coke to highly reactive peat have been gasified successfully in the this pilot plant, indicating its ability to handle a feedstock with widely varying properties. A new 10 megawatt pilot plant has been designed and is under construction in Tampere, Finland, as the first step toward the commercialization of this technology. Tampella is planning to design and deliver a commercial-scale IGCC demonstration plant by 1994. 7 refs., 5 figs.

6161 (CONF-9109211–Absts.) **Liquefaction contractors' review meeting: Abstracts.** USDOE Pittsburgh Energy Technology Center, PA (United States). [1991]. 38p. Sponsored by U.S. DOE Fossil Energy. From Direct liquefaction contractors' review meeting; Pittsburgh, PA (United States); 3-5 Sep 1991. Order Number DE92003113. Source: OSTI; NTIS; GPO Dep.

The US Department of Energy and Pittsburgh Energy Technology Center sponsored a Contractors' Review Meeting in Pittsburgh, Pennsylvania September 3–5, 1991. This report is a compilation of the abstracts for talks presented at the meeting.

6162 (DOE/MC/11076–3017) **Mild gasification of Usibelli coal in an inclined fluidized-bed reactor.** Merriam, N.W.; Thomas, K.P.; Cha, C.Y. Western Research Inst., Laramie, WY (United States). Feb 1991. 52p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FC21-86MC11076. Order Number DE91002097. Source: OSTI; NTIS; GPO Dep.

Results of mild gasification tests of minus 16-mesh Usibelli coal in an inclined fluidized-bed reactor are described in this report. The minus 16-mesh fraction was separated from the coal by screening. The coal was dried to zero moisture content, and about 2 wt % of the volatiles was removed as gas by partial decarboxylation using a 100-lb/hr inclined fluidized-bed dryer. The dried coal was subjected to mild gasification at maximum temperatures of 1050 to 1250°F (566 to 677°C) and feed rates of 7.5 lb/hr while using a once-through flow of carbon dioxide as fluidizing gas in a 1-inch-wide, inclined fluidized-bed reactor. Mild gasification of the dried coal resulted in production of 44 to 56 wt % of the dried coal as char, 10 to 13 wt % as liquids, 17 to 28 wt % as gas, and 8 to 21 wt % as fines. The yield of moisture- and ash-free (MAF) liquids varied from 11.4 to 14.2 wt % of the dried coal feed. Chemical analysis was carried out on these products.

6163 (DOE/MC/24248–3015) **Development and application of a probabilistic evaluation method for advanced process technologies: Final report.** Frey, H.C.; Rubin, E.S. Carnegie-Mellon Univ., Pittsburgh, PA (United States). Center for Energy and Environmental Studies. Apr 1991. 364p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC21-88MC24248. Order Number DE91002095. Source: OSTI; NTIS; GPO Dep.

The objective of this work is to develop and apply a method for research planning for advanced process technologies. To satisfy requirements for research planning, it is necessary to: (1) identify robust solutions to process design questions in the face of uncertainty to eliminate inferior design options; (2) identify key problem areas in a technology that should be the focus of further research to reduce the risk of technology failure; (3) compare competing technologies on a consistent basis to determine the risks associated with adopting a new technology; and (4) evaluate the effects that additional research might have on comparisons with conventional technology. An important class of process technologies are electric power plants. In particular, advanced clean coal technologies are expected to play a key role in the energy and environmental future of the US, as well as in other countries. Research planning for advanced clean coal technology development is an important part of energy and environmental policy. Thus, the research planning method developed here is applied to case studies focusing on a specific clean coal technology. The purpose of the case studies is both to demonstrate the research planning method and to obtain technology-specific conclusions regarding research strategies.

6164 (DOE/MC/25006–3011) **Enhanced durability of desulfurization sorbents for fluidized-bed applications.** Gupta, R.P.; Gangwal, S.K. Research Triangle Inst., Research Triangle Park, NC (United States). Jun 1991. 101p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC21-88MC25006. Order Number DE91002090. Source: OSTI; NTIS; GPO Dep.

Advanced integrated gasification combined cycle (IGCC) power systems require the development of high-temperature desulfurization sorbents capable of removing hydrogen sulfide from coal gasifier down to very low levels. The objective of this investigation was to identify and demonstrate methods for enhancing the long-term chemical reactivity and mechanical strength of zinc ferrite, a leading regenerable sorbent, for fluidized-bed applications. Fluidized sorbent beds offer significant potential in IGCC systems because of their ability to control the highly exothermic regeneration involved. However, fluidized beds require a durable, attrition-resistant sorbent in the 100–300 μm size range. A bench-scale high-temperature, high- pressure (HTHP) fluidized-bed reactor (7.6-cm I.D.) system capable of operating up to 24 atm and 800°C was designed, built and tested. A total of 175 sulfidation-regeneration cycles were carried out using KRW-type coal gas with various zinc ferrite formulations. A number of sorbent manufacturing techniques including spray drying, impregnation, crushing and screening, and granulation were investigated. While fluidizable sorbents prepared by crushing durable pellets and screening had acceptable sulfur capacity, they underwent excessive attrition during multicycle testing. The sorbent formulations prepared by a proprietary technique were found to have excellent attrition resistance and acceptable chemical reactivity during multicycle testing. However, zinc ferrite was found to be limited to 550°C, beyond which excessive sorbent weakening due to chemical transformations, e.g., iron oxide reduction, was observed.

6165 (DOE/PC/79816–8) **Slurry phase Fischer-Tropsch synthesis: Cobalt plus a water-gas shift catalyst, January 1, 1990–March 30, 1990.** Yates, I.C.; Satterfield, C.N. Massachusetts Inst. of Tech., Cambridge, MA (United States). [1990]. 6p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-87PC79816. Order Number DE92004500. Source: OSTI; NTIS; GPO Dep.

Experiments to study cobalt-catalyzed reactions of light 1-alkenes added to synthesis gas feed have been performed. Data have been collected at 220°C, 0.45 to 1.48 MPa and a synthesis gas flow rate between 0.015 and 0.030 Nl/(gcatmin) with H_2/CO of 1.45 to 2.25. C_2H_4, C_3H_6, and C_4H_8 were added to the synthesis gas feed in concentrations ranging from 0.5 to 1.2 mole% of total feed. For each material balance in which 1-alkenes were added, a material balance was performed at similar process conditions without 1-alkenes added. This use of "base case" process conditions should make data analysis and interpretation easier. Material balances without 1-alkenes were also repeated to allow verification of catalyst selectivity stability. A total of 49 balances were performed during a single run which lasted over 2500 hours-on-stream. The hydrocarbon data have not yet been completed analyzed.

6166 (DOE/PC/88802–T7) **Exploratory coprocessing research: Quarterly report no. 6, December 1, 1989–February 28, 1990.** Hirschon, A.S.; Tse, D.S.; Malhorta, R.; McMillen, D.F.; Ross, D.S. SRI International, Menlo Park, CA (United States). Apr 1990. 9p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-88PC88802. Order Number DE92003087. Source: OSTI; NTIS; GPO Dep.

The objectives of this quarter's work were to conduct coprocessing experiments in our new microreactor system, where the reactors are agitated by an electric reciprocating saw. Since Wyodak coal was shown to be more susceptible to pretreatment in the larger, 300-mL autoclaves, we decided to begin with this coal. Coprocessing experiments were conducted using pretreatments at 250°C and at 350°C, where a ratio of 1 part coal and 2 parts Maya ATB and 1200 psig of hydrogen was heated at 425°C. In each case the pretreatment increased the conversions, in agreement with the experiments in the larger autoclave. Based on hexane insoluble material, coal conversions ranged from 40% for conversions with no pretreatment, to 60% conversion with pretreatment at 350°C. The 350°C pretreatment gave the greatest degree of conversion which is consistent with FIMS pyrolysis data described in the previous quarter. In future work, pretreatment by other methods will also be conducted, as well as a more thorough evaluation of the aqueous pretreatment. 4 refs., 1 fig., 1 tab.

6167 (DOE/PC/88802–T8) **Exploratory coprocessing research: Final report, September 1988–June 1991.** Hirschon, A.S.; Tse, D.S.; Malhotra, R.; McMillen, D.F.; Ross, D.S. SRI International, Menlo Park, CA (United States). 5 Sep 1991. 60p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-88PC88802. Order Number DE92004846. Source: OSTI; NTIS; GPO Dep.

The objectives of this project were to (1) study the scope of the beneficial effects of hydrothermal pretreatment of coal on subsequent conversion, (2) identify and study the chemical or physical causes of this effect, and (3) attempt to elucidate the chemistry responsible for any coal-resid synergisms.

6168 (DOE/PC/88818–10) **Two-stage, close coupled catalytic liquefaction of coal: Tenth quarterly report, 1 January 1991–31 March 1991.** Comolli, A.G.; Johanson, E.S.; Panvelker, S.V.; Popper, G.A.; Stalzer, R.H. Hydrocarbon Research, Inc., Princeton, NJ (United States). Aug 1991. 50p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-88PC88818. Order Number DE92004520. Source: OSTI; NTIS; GPO Dep.

The first calendar quarter of 1991 was a productive period with two bench-scale studies, microautoclave support studies, mini-Process Development Unit (PDU) preparations, and process modelling. Several catalyst presulfiding agents and CO_2 effects upon liquefaction were evaluated in microautoclave scale tests. Dimethyl disulfide will be used for the PDU scale-up based on the results of these tests and prior data. Carbon dioxide appears to enhance coal conversion; however, gas and water yields are increased indicating possible water gas shift-hydrocarbon synthesis reactions. In the bench-scale studies, the rejuvenation of spent catalyst with acid and carbon burn-off produced catalytic activity akin to fresh and catalyst in a 12 day evaluation. A 14 day study of the addition of high concentrations of CO_2 to a sub-bituminous coal liquefaction system demonstrated the occurrence of water gas shift hydrocarbon synthesis reactions and conversely higher coal conversions and distillate yields with high hydrogen consumptions. Preparations for a PDU Demonstration Run on Black Thunder Mine coal are underway. The British Coal Filtration Process will be used for solid separation. The results of microautoclave scale tests on Illinois, Ohio and Black Thunder Mine coals were reviewed and statistically analyzed to provide a sound basis for kinetic interpretation.

6169 (DOE/PC/88927–12) **Mechanistic and kinetic studies of high-temperature coal gas desulfurization sorbents: Final report, July 1988–July 1991.** Lew, S.; Flytzani-Stephanopoulos, M.; Sarofim, A.F. Massachusetts Inst. of Tech., Cambridge, MA (United States). Dept. of Chemical Engineering. Oct 1991. 206p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-88PC88927. Order Number DE92004184. Source: OSTI; NTIS; GPO Dep.

The overall objective of this project was to investigate the properties of and evaluate mixed oxides of zinc and titanium for hot fuel gas desulfurization. Uncombined ZnO was also investigated as a base case. Detailed investigation of the reduction and sulfidation reactions of Zn-Ti-O sorbents was performed. The intrinsic kinetics and the product layer diffusion rates in reduction and sulfidation were determined. Kinetic experiments with sorbents containing various Zn/Ti atomic ratios were performed. Chemical phase and structural transformations were followed by various methods. The results were compared to similar experiments performed with ZnO. The purpose of these experiments was to determine how the presence of titanium dioxide affects the reduction and sulfidation of ZnO. This information would be used to identify and select the sorbent composition that gives the best combination of low reduction rate and acceptable sulfidation performance at temperatures exceeding 600°C. (VC)

6170 (DOE/PC/88935–T9) **Inhibition of retrogressive reactions in coal/petroleum co-processing: Quarterly technical progress report, July 1, 1991–September 30, 1991.** Schobert, H.H.; Tomic, J. Pennsylvania State Univ., University Park, PA (United States). Nov 1991. 20p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-88PC88935. Order Number DE92005141. Source: OSTI; NTIS; GPO Dep.

The overall objective of this project is to develop a fundamental understanding of the reactions occurring at the onset of coke formation during the co-processing of coals with petroleum residua. The specific objectives include examination of chemical components, or groups of components, in coals and petroleum feedstocks to quantify and rank the effects of these components in retarding or enhancement of coke formation. The work involves bench scale reactions in microautoclaves, supplemented by studies of the carbonaceous residues by such techniques as diffuse reflectance Fourier transform infrared spectroscopy and ^{13}C nuclear magnetic resonance spectrometry.

6171 (DOE/PC/89770–T3) **Preconversion catalytic deoxygenation of phenolic functional groups: Quarterly technical progress report, April 1, 1991–June 30, 1991.** Kubiak, C.P. Purdue Univ., Lafayette, IN (United States). Dept. of Chemistry. [1991]. 13p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-89PC89770. Order Number DE92005198. Source: OSTI; NTIS; GPO Dep.

The deoxygenation of phenols is a conceptually simple, but unusually difficult chemical transformation to achieve. Aryl carbon-oxygen bond cleavage is a chemical transformation of importance in coal liquefaction and the upgrading of coal liquids as well as in the synthesis of natural products. This proposed research offers the possibility of effecting the selective catalytic deoxygenation of phenolic functional groups using CO. A program of research for the catalytic deoxygenation of phenols, via a low energy mechanistic pathway that is based on the use of the CO/CO_2 couple to remove phenolic oxygen atoms, is underway. We are focusing on systems which have significant promise as catalysts: Ir(triphos)OPh, $[Pt(triphos)OPh]^+$ and Rh(triphos)OPh. Our studies of phenol deoxygenation focus on monitoring the reactions for the elementary processes upon which catalytic activity will depend: CO insertion into M-OPh bonds, CO_2 elimination from aryloxy carbonyls {M-C(O)-O-Ph}, followed by formation of a coordinated benzyne intermediate.

6172 (DOE/PC/89775–6) **Control of catalytic hydrotreating selectivity with ammonia: Quarterly report, July 1, 1991–September 30, 1991.** Satterfield, C.N.; Lee, C.M. Massachusetts Inst. of Tech., Cambridge, MA (United States). [1991]. 16p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-89PC89775. Order Number DE92003082. Source: OSTI; NTIS; GPO Dep.

The hydrogenation of phenanthrene in the presence of 24 kPa of ammonia was studied during the hydrodenitrogenation (HDN) of quinoline on a sulfided $NiMo/Al_2O_3$ catalyst at 360°C, 6.9 MPa total H_2 pressure in a vapor phase tubular reactor. Ammonia, through competitive adsorption, reduced the formation of phenanthrene hydrogenated products and the hydrocracking of 9,10-dihydrophenanthrene to biphenyl. The effects occur largely when the HDN reactions are substantially completed. 6 refs., 8 figs., 1 tab.

6173 (DOE/PC/89781–8) **A novel coal feeder for production of low sulfur fuel: Annual technical progress report, October 1, 1990–October 1, 1991.** Khang, S.J.; Lin, L.; Keener, T.C.; Yeh, P. Cincinnati Univ., OH (United States). [1991]. 56p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-89PC89781. Order Number DE92004521. Source: OSTI; NTIS; GPO Dep.

A dual-screw feeder was designed for desulfurization of coal. This reactor contains two screw tubes, the inner tube acting as a coal pyrolizer and the outer tube acting as a desulfurizer with hot calcined lime pellets or other renewable sorbent pellets. The objectives of this project is to study the feasibility of an advanced concept of desulfurization and possibly some denitrification in this coal feeder. In this year, two basic studies have been performed: (1) the desulfurization and (2) the denitrification due to mild pyrolysis. Specifically, the following tasks have been performed: (1) Setting up the Dual-Screw reactor, (2) Determination of the pyrolysis product and the sulfur distribution in char, tar and gas based on experimental data, (3) Study of the devolatilization, the desulfurization kinetics and the denitrification kinetics and obtaining the basic kinetic parameters, (4) Study of the sulfur removal efficiency of lime pellets fed into the outer tube of the dual-feeder reactor, (5) Study of the effect of the coal particle size on pyrolysis and desulfurization, (6) Study of the coal pyrolysis and desulfurization using a TGA(Thermal Gravimetric Analyzer).

6174 (DOE/PC/89787–T2) **Novel reactor configuration for synthesis gas conversion to alcohols: Quarterly report, July 1, 1991–September 30, 1991.** Akgerman, A.; Anthony, R.G. Texas A and M Univ., College Station, TX (United States). Dept. of Chemical Engineering. 1991. 11p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-89PC89787. Order Number DE92004873. Source: OSTI; NTIS; GPO Dep.

Our objectives during this quarter were to complete construction and shake down runs on our new reactor assemblies, obtain activity data on the catalyst employing the slurry reactor, incorporate pressure drop and change in number of moles options into our reactor simulation code and start experiments in the trickle bed reactor.

6175 (DOE/PC/89790–8) **Chemistry of coal-related microparticles: [Quarterly report], 1 July 1991–31 September 1991.** Davis, E.J.; Krieger-Brockett, B. Washington Univ., Seattle, WA (United States). Dept. of Chemical Engineering. [1991]. 4p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-89PC89790. Order Number DE92004523. Source: OSTI; NTIS; GPO Dep.

The objective of this research is to develop and apply novel single microparticle techniques to perform simultaneously thermogravimetric analysis and Raman/fluorescence spectroscopies on microparticles of coal (macerals) and sorbents (CaO) used for coal desulfurization. The combination electrodynamic balance/spectrometer system is being used to chemically characterize macerals from different ranks of coal and to explore the chemistry and chemical reaction rates associated with processes involving such microparticles. Rate processes will be examined at elevated temperatures by heating the particles electromagnetically, and significant part of the research involves the design, construction and utilization of a microparticle heating system.

6176 (DOE/PC/89878–T6) **Fundamental studies of water pretreatment of coal: Seventh quarterly report, April 1, 1991–June 30, 1991.** Serio, M.A.; Solomon, P.R.; Kroo, E.; Charpenay, S.; Bassilakis, R. Advanced Fuel Research, Inc., East Hartford, CT (United States). 25 Oct 1991. 12p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-89PC89878. Order Number DE92004871. Source: OSTI; NTIS; GPO Dep.

During the seventh quarter, water pretreatment experiments were done at lower pressures (1000 psig), with early H_2O injection or continuous H_2O injection, and with demineralized coals. In addition, a set of blank experiments was done with all four coals in helium at the following conditions: 350°C; 4000 psig; 20 minutes. An additional experiment was done with the Zap lignite at atmospheric pressure. Helium was used instead of nitrogen since it can be obtained in highly pure grades. The purpose of the blank experiments is to determine how much of the water pretreatment process is a thermal and/or pressure effort. The residues from the standard water pretreatment experiments with Illinois and Pittsburgh coals were subjected to analysis by TG-FTIR, solvent extraction, solvent swelling, oxygen reactivity index and donor solvent liquefaction. The pyridine extractables were analyzed. With regard to liquefaction behavior, improvements in the yields of oils and toluene solubles are observed for selected Illinois and Pittsburgh coals at longer pretreatment times ($\geq$ 60 minutes).

6177 (DOE/PC/89883–27) **Coal liquefaction process streams characterization and evaluation: Quarterly technical progresss report, January 1–March 31, 1991.** Brandes, S.D.; Winschel, R.A.; Burke, F.P.; Robbins, G.A. Consolidation Coal Co., Library, PA (United States). Research and Development Dept. Sep 1991. 53p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-89PC89883. Order Number DE92004518. Source: OSTI; NTIS; GPO Dep.

Consol R&D is conducting a three-year program to characterize process and product streams from direct coal liquefaction process development projects. The program objectives are two-fold: (1) to obtain and provide appropriate samples of coal liquids for the evaluation of analytical methodology, and (2) to support ongoing DOE-sponsored coal liquefaction process development efforts. The two broad objectives have considerable overlap and together serve to provide a bridge between process development and analytical chemistry.

6178 (DOE/PC/90005–T51) **Liquid phase methanol LaPorte process development unit: Modification, operation, and support studies: Task 2.2, Alternate catalyst Run E-6 and catalyst activity maintenance Run E-7: Appendix A, Run E-6 detailed data acquisition sheets: Appendix B, Run E-7 detailed data acquisition sheets.** Air Products and Chemicals, Inc., Allentown, PA (United States); Chem Systems, Inc., Tarrytown, NY (United States). 2 Feb 1991. 445p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-87PC90005. Order Number DE92000280. Source: OSTI; NTIS; GPO Dep.

This report consists of Detailed Data Acquisition Sheets for Runs E-6 and E-7 for Task 2.2 of the Modification, Operation, and Support Studies of the Liquid Phase Methanol Laporte Process Development Unit. (Task 2.2: Alternate Catalyst Run E-6 and Catalyst Activity Maintenance Run E-7).

6179 (DOE/PC/90005–T53) **Liquid phase methanol LaPorte process development unit: Modification, operation, and support studies: Task 2.2, Alternate catalyst Run E-6 and catalyst activity maintenance Run E-7.** Air Products and Chemicals, Inc., Allentown, PA (United States); Chem Systems, Inc., Tarrytown, NY (United States). 2 Feb 1991. 85p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-87PC90005. Order Number DE92000279. Source: OSTI; NTIS; GPO Dep.

The primary focus of this Process Development Unit operating program was to prepare for a confident move to the next scale of operation with a simplified and optimized process. The main purpose of these runs was the evaluation of the alternate commercial catalyst (F21/0E75-43) that had been identified in the laboratory under a different subtask of the program. If the catalyst proved superior to the previous catalyst, then the evaluation run would be continued into a 120-day life run. Also, minor changes were made to the Process Development Unit system to improve operations and reliability. The damaged reactor demister from a previous run was replaced, and a new demister was installed in the intermediate V/L separator. The internal heat exchanger was equipped with an expansion loop to relieve thermal stresses so operation at higher catalyst loadings and gas velocities would be possible. These aggressive conditions are important for improving process economics. (VC)

6180 (DOE/PC/90005–T54) **Liquid phase methanol LaPorte process development unit: Modification, operation, and support studies: Task 3.5: Development of fundamental rate models for methanol synthesis in a slurry reactor.** Air Products and Chemicals, Inc., Allentown, PA (United States); Chem Systems, Inc., Tarrytown, NY (United States). 11 Mar 1991. 54p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-87PC90005. Order Number DE92002585. Source: OSTI; NTIS; GPO Dep.

The objectives of the present work can be divided into three parts. The first objective was to develop a best-fit model for the older methanol synthesis catalyst (BASF S3-85) data base. At the time that this work commenced (June 1989), the BASF S3-85 data base contained many rate measurements accumulated over a few years. The newer catalyst (BASF S3-86) data base, at that time, contained only a few observations and did not include a broad range of conditions. Thus, a second objective of this work was to expand the BASF S3-86 data base to include more rate observations over a broader range of conditions. Finally, after expansion of the BASF S3-86 data base, the third objective was to develop a rate expression to describe this data base. This would include the application of rate expressions developed for the BASF S3-85 catalyst, as well as new models. (VC)

6181 (DOE/PC/90044–4) **High octane ethers from synthesis gas-derived alcohols: Technical progress report, July 1, 1991–September 30, 1991.** Klier, K.; Herman, R.G.; Johannson, M.; Feeley, O.C.; Bogar, S.; Lawson, E.; Kieke, M. Lehigh Univ., Bethlehem, PA (United States). Zettlemoyer Center for Surface Studies. Nov 1991. 42p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-90PC90044. Order Number DE92004519. Source: OSTI; NTIS; GPO Dep.

The objective of the proposed research is to synthesize high octane ethers, primarily methyl isobuty ether (MIBE) and methyl tertiary butyl ether (MTBE), directly from $H_2/CO/CO_2$ coal-derived synthesis gas via alcohol mixtures that are rich in methanol and 2-methyl-1-butanol (isobutanol). The overall scheme involves gasification of coal, purification and shifting of the synthesis gas, higher alcohol synthesis, and direct synthesis of ethers.

6182 (DOE/PC/90176–T50) **Ultrasound-promoted chemical desulfurization of Illinois coals: Final technical report, September 1, 1990–August 31, 1991.** Chao, S.S. Institute of Gas Technology, Chicago, IL (United States). [1991]. 36p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-90PC90176. Order Number DE92004186. Source: OSTI; NTIS; GPO Dep.

The overall objectives of the program were to investigate the use of ultrasound to promote coal desulfurization reactions and to evaluate chemical coal desulfurization schemes under mild conditions through a fundamental understanding of their reaction mechanisms and kinetics. The ultimate goal was to develop an economically feasible mild chemical process to reduce the total sulfur content of Illinois Basin Coals, while retaining their original physical characteristics, such as calorific value and volatile matter content. During the program, potential chemical reactions with coal were surveyed under various ultrasonic irradiation conditions for desulfurization, to formulate preliminary reaction pathways, and to select a few of the more promising chemical processes for more extensive study.

6183 (DOE/PC/90176–T51) **Chemical coal cleaning using selective oxidation: Final technical report, September 1, 1990–August 31, 1991.** Palmer, S.R.; Hippo, E.J. Southern Illinois Univ., Carbondale, IL (United States). Dept. of Mechanical Engineering and Energy Processes. [1991]. 28p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-90PC90176. Order Number DE92004187. Source: OSTI; NTIS; GPO Dep.

The primary objective of this study is to investigate the removal of both mineral and organic sulfur from Illinois coals using low temperature selective oxidation. This overall objective is to develop new methods for either physical/chemical or physical/microbial cleaning of Illinois coal. Innovative approaches to achieve deep cleaned products, containing both ash and sulfur contents less than 0.5 percent, will be considered. Experiments focus on developing cost-effective methods for the removal of organic sulfur and finely disseminated mineral impurities, especially fine pyrite particles, from coal. Rates and mechanisms for organic sulfur removal will be studied. Chemical reagent recycling and/or reagent wastes will be studied. Chemical reagent recycling and/or reagent wastes handling are included. Bench scale studies are performed.

6184 (DOE/PC/90176–T52) **Evaluation of sulfur-reducing microorganisms for organic desulfurization: Final technical report, September 1, 1990–August 31, 1991.** Miller, K.W. Illinois State Univ., Normal, IL (United States). Dept. of Biological Sciences. [1991]. 31p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-90PC90176. Order Number DE92004188. Source: OSTI; NTIS; GPO Dep.

Because of substantial portion of the sulfur in Illinois coal is organic, microbial desulfurization of sulfidic and thiophenic functionalities could hold great potential for completing pyritic sulfur removal. We are testing the hypothesis that organic sulfur can be reductively removed as H_2S through the activities of anaerobic microorganisms. Our objectives for this year include the following: (1) To obtain cultures that will reductively desulfurize thiophenic model compounds. In addition to crude oil enrichments begun last year, we sampled municipal sewage sludge. (2) To continue to work toward optimizing the activity of the DBDS-reducing cultures obtained during the previous year. (3) To expand coal desulfurization work to include other coals including Illinois Basin Coal 101 and a North Dakota lignite, which might be more susceptible to the dibenzyldisulfide reducing cultures due to its lower rank. (4) To address the problem of sulfide sorption, by investigating the sorption capacity of coals in addition to Illinois Basin Coal 108.

6185 (DOE/PC/90176–T53) **Bioconversion of coal-derived synthesis gas to liquid fuels: Final technical report, September 1, 1990–August 31, 1991.** Jain, M.K. Michigan Biotechnology Inst., Lansing, MI (United States). [1991]. 35p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-90PC90176. Order Number DE92004189. Source: OSTI; NTIS; GPO Dep.

The use of coal-derived synthesis gas as an industrial feedstock for production of fuels and chemicals has become an increasingly attractive alternative to present petroleum-based chemicals production. However, one of the major limitations in developing such a process is the required removal of catalyst poisons such as hydrogen sulfide (H_2S), carbonyl sulfide (COS), and other trace contaminants from the synthesis gas. Purification steps necessary to remove these are energy intensive and add significantly to the production cost, particularly for coals having a high sulfur content such as Illinois coal. A two-stage, anaerobic bioconversion process requiring little or no sulfur removal is proposed, where in the first stage the carbon monoxide (CO) gas is converted to butyric and acetic acids by the CO strain of Butyribacterium methylotrophicum. In the second stage, these acids along with the hydrogen (H_2) gas are converted to butanol, ethanol, and acetone by an acid utilizing mutant of Clostridium acetobutylicum. 18 figs., 18 tabs.

6186 (DOE/PC/90176–T56) **Genetic engineering of sulfur-degrading Sulfolobus: Final technical report, September 1, 1990–August 31, 1991.** Ho, N.W.Y. Purdue Univ., Lafayette, IN (United States). Lab. of Renewable Resources Engineering. [1991]. 16p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-90PC90176. Order Number DE92004192. Source: OSTI; NTIS; GPO Dep.

The objectives of the proposed research is to first establish a plasmid-mediated genetic transformation system for the sulfur degrading Sulfolobus, and then to clone and overexpress the genes encoding the organic-sulfur-degrading enzymes from Sulfolobus as well as from other microorganisms, to develop a Sulfolobus-based microbial process for the removal of both organic and inorganic sulfur from coal.

6187 (DOE/PC/90176–T58) **Combined chemical and microbiological removal of organic sulfur from coal: Technical report, September 1, 1990–August 31, 1991.** Raphaelian, L.A. Institute of Gas Technology, Chicago, IL (United States). [1991]. 26p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-90PC90176. Order Number DE92004194. Source: OSTI; NTIS; GPO Dep.

The objective of this work is to investigate techniques for chemically converting the sulfur containing organic compounds in coal to compounds that can be treated microbiologically to remove the organically bound sulfur. The goal is to achieve an economically feasible mild chemical oxidation of the organic sulfur in a representative Illinois Basin coal by converting the sulfur to sulfoxides and sulfones; the carbon sulfur bond in the sulfoxides and sulfones would then be broken microbiologically and the sulfur removed from the coal as sulfate.

6188 (DOE/PC/90176–T60) **VHF EPR determination of the chemical forms of organic sulfur in coal: Final technical report, September 1, 1990–August 31, 1991.** Clarkson, R.B. Illinois Univ., Urbana, IL (United States). [1991]. 24p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-90PC90176. Order Number DE92004196. Source: OSTI; NTIS; GPO Dep.

This program addresses the need for innovative approaches to characterize the organic sulfur in Illinois Basin coals. We have developed a very high frequency electron paramagnetic resonance

(EPR) spectrometer operating at the W-band of microwave frequencies (96 GHz). This instrument has shown unique sensitivity to heteroatoms in coal, and we believe the technique can be successfully applied for the non-destructive, direct determination of organic sulfur in coal. Preliminary data from Illinois coals and separated macerals indicate that the method also may be able to distinguish aromatic from aliphatic sulfur, and may be useful in assessing the extent of conjugation in aromatic portions of the coal. These high energy spectroscopic techniques, however invariably suffer from the fact that they are not truly non-destructive. By contrast, the low powers and relatively low energy radiation used in magnetic resonance techniques have virtually no effect on the physical structure or chemical composition of coal.

6189 (DOE/PC/90176–T63) **New regents for coal desulfurization: Final technical report, September 1, 1990–August 31, 1991.** Buchanan, D.H.; Kalembasa, S.; Olson, D.; Wang, S.; Warfel, L. Eastern Illinois Univ., Charleston, IL (United States). [1991]. 28p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-90PC90176. Order Number DE92004199. Source: OSTI; NTIS; GPO Dep.

The primary goal of this project was development and exploration of potential new desulfurization reagents for the removal of "organic sulfur" from Illinois coals by mild chemical methods. Potential new desulfurization reagents were investigated using organic sulfur compounds of the types thought to be present in coals. Reagents included low-valent metal complexes based on nickel and on iron as well as possible Single Electron Transfer reagents. Soluble coal extracts served as second generation model compounds during this reagent development project.

6190 (DOE/PC/90523–11) **Phase behavior of coal fluids: Data for correlation development: Report period: August 15, 1989–October 15, 1989.** Robinson, R.L. Jr.; Gasem, K.A.M.; Shaver, R.D. Oklahoma State Univ., Stillwater, OK (United States). School of Chemical Engineering. 15 Oct 1989. 28p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-86PC90523. Order Number DE92004325. Source: OSTI; NTIS; GPO Dep.

During the present report period, our framework for correlating saturation properties using the scaled-variable-reduced coordinate approach was used to develop a correlation for saturated liquid densities of pure fluids at temperatures from the triple point to the critical point. The new correlation results in precise representation of liquid densities of diverse chemical species with average errors of 0.12% when two adjustable parameters are used to characterize each substance. In addition, the proposed model compares favorably with the modified Rackett and the Hankinson-Thomson correlations with the added advantages of covering the full saturation range and obeying scaling-law behavior in the near-critical region. Although the approach is essentially empirical, the results obtained suggest an underlying physical significance for the model parameters and show an excellent potential for generalized predictions. This is demonstrated by the results given here for saturated liquid densities where fully generalized predictions yield average errors of less than 1.0%.

6191 (DOE/PC/90523–T8) **Phase equilibrium data for development of correlations for coal fluids: Final report, 15 September 1986–15 September 1990.** Robinson, R.L. Jr.; Gasem, K.A.M.; Darwish, N.A.; Raff, A.M. Oklahoma State Univ., Stillwater, OK (United States). School of Chemical Engineering. 1 Feb 1991. 99p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-86PC90523. Order Number DE92001656. Source: OSTI; NTIS; GPO Dep.

The overall objective of the authors' work is to develop accurate predictive methods for representations of vapor-liquid equilibria in systems encountered in coal-conversion processes. The objectives pursued in the present project include: (1) Measurements of binary vapor-liquid phase behavior data for selected solute gases (e.g., C_2H_6, CH_4) in a series of paraffinic, naphthenic, and aromatic hydrocarbon solvents to permit evaluations of interaction parameters in models for phase behavior. Solubilities of the gases in the liquid phase have been determined. (2) Evaluation of existing equations of state and other models for representations of phase behavior in systems of the type studied experimentally; development of new correlation frameworks as needed. (3) Generalization of the interaction parameters for the solutes studied to a wide spectrum of heavy solvents; presentation of final results in formats useful in the design/optimization of coal liquefaction processes.

6192 (DOE/PC/90523–T9) **Phase behavior of coal fluids: Data for correlation development: Report for the period October 15, 1989–January 15, 1990.** Robinson, R.L. Jr. Oklahoma State Univ., Stillwater, OK (United States). School of Chemical Engineering. 6 Feb 1990. 36p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-86PC90523. Order Number DE92004322. Source: OSTI; NTIS; GPO Dep.

The effective design and operation of processes for conversion of coal to fluid fuels requires accurate knowledge of the phase behavior of the fluid mixtures encountered in the conversion process. Multiple phases are present in essentially all stages of feed preparation, conversion reactions and product separation; thus, knowledge of the behavior of these multiple phases is important in each step. The overall objective of the author's work is to develop accurate predictive methods for representation of vapor-liquid equilibria in systems encountered in coal conversion processes. 59 refs., 6 figs., 7 tabs.

6193 (DOE/PC/91026–T2) **The dual role of oxygen functions in coal pretreatment and liquefaction: Crosslinking and cleavage reactions: Second quarterly report, July 1, 1991–September 30, 1991.** Serio, M.A.; Kroo, E.; Teng, Hsisheng; Charpenay, S.; Solomon, P.R. Advanced Fuel Research, Inc., East Hartford, CT (United States). [1991]. 8p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-91PC91026. Order Number DE92004911. Source: OSTI; NTIS; GPO Dep.

One objective of this program is to prepare polymer models having phenolic, carboxylic, and/or aryl ether groups considered to be important in low rank coals. In order to study the chemistry of these functional groups in a polymeric matrix, it is necessary that the polymer backbone itself should not be subject to cleavage under the reaction conditions. It is expected that poly(phenylene) would fulfill this requirement as a backbone, while providing simple mechanical routes for attaching other functional groups. During this reporting period, the synthesis of oligomeric species such as sexi(phenylene) and octa(phenylene) was explored. The procedure of Bamfield and Quam was followed, which involves heating a paste of bromoarenes, water, sodium formate and Pd/C. The reaction products turned out to be very insoluble and difficult to purify. The insolubility of these products makes them difficult to work with, and it is doubtful that we will be able to prepare well-characterized polymers in the 10,000 Da range. We are presently considering other polymeric substrates that might serve as the backbone. Pending the resolution of the polymeric substrate issue, the thermal behavior of the carboxyl and phenolic functions and the effect of ion-exchange will be studied using monomeric models. These studies will be needed to establish the baseline for considering the effect of the polymeric environment.

6194 (ORNL–6650) **Fossil Energy Program semiannual progress report, April 1990– September 1990.** Judkins, R.R. Oak Ridge National Lab., TN (United States). Sep 1991. 143p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC05-84OR21400. Order Number DE92004596. Source: OSTI; NTIS; GPO Dep.

This report covers progress made during the period April 1, 1990, through September 30, 1990, for research and development projects that contribute to the advancement of various fossil energy technologies. Topics discussed include: ceramics and composite materials R&D, new alloys, corrosion and erosion research, coal conversion development, mild gasification. (VC)

6195 **Process and apparatus for coal hydrogenation.** Ruether, J.A.; Simpson, T.B. To Dept. of Energy. 1990. Filed date 10 Apr 1990. USA Patent patent application 7-506,739. 17p. Sponsored by U.S. DOE Fossil Energy. Order Number DE92003874. Source: OSTI; NTIS; GPO Dep.

In a coal liquefaction process an aqueous slurry of coal is prepared containing a dissolved liquefaction catalyst. A small quantity of oil is added to the slurry and then coal-oil agglomerates are prepared by agitation of the slurry at atmospheric pressure. The resulting mixture is drained of excess water and dried at atmospheric pressure leaving catalyst deposited on the agglomerates. The agglomerates then are fed to an extrusion device where they are formed into a continuous ribbon of extrudate and fed into a hydrogenation reactor at elevated pressure and temperature. The catalytic hydrogenation converts the extrudate primarily to liquid hydrocarbons in the reactor. The liquid drained in recovering the agglomerates is recycled. 1 fig.

6196 Improved catalysts and method. Taylor, C.E.; Noceti, R.P. To Dept. of Energy. 1990. Filed date 30 Apr 1990. USA Patent patent application 7-516,611. 28p. Sponsored by U.S. DOE Fossil Energy. Order Number DE92004610. Source: OSTI; NTIS; GPO Dep.

An improved catalyst and method for the oxyhydrochlorination of methane is disclosed. The catalyst includes a pyrogenic porous support on which is layered as active material, cobalt chloride in major proportion, and minor proportions of an alkali metal chloride and of a rare earth chloride. On contact of the catalyst with a gas flow of methane, HCl and oxygen, more than 60% of the methane is converted and of that converted more than 40% occurs as monochloromethane. Advantageously, the monochloromethane can be used to produce gasoline boiling range hydrocarbons with the recycle of HCl for further reaction. This catalyst is also of value for the production of formic acid as are analogous catalysts with lead, silver or nickel chlorides substituted for the cobalt chloride. 8 figs., 3 tabs.

6197 Method for dispersing catalyst onto particulate material. Utz, B.R.; Cugini, A.V. To Dept. of Energy. 1990. Filed date 1 Jun 1990. USA Patent patent application 7-531,722. 19p. Sponsored by U.S. DOE Fossil Energy. Order Number DE92003741. Source: OSTI; NTIS; GPO Dep.

A method for dispersing finely divided catalyst precursors onto the surface of coal or other particulate material includes the steps of forming a wet paste mixture of the particulate material and a liquid solution containing a dissolved transition metal salt, for instance a solution of ferric nitrate. The wet paste mixture is in a state of incipient wetness with all of this solution adsorbed onto the surfaces of the particulate material without the presence of free moisture. On adding a precipitating agent such as ammonia, a catalyst precursor such as hydrated iron oxide is deposited on the surfaces of the coal. The catalyst is activated by converting it to the sulfide form for the hydrogenation or direct liquefaction of the coal. 2 figs., 1 tab.

6198 Method and apparatus for hot-gas desulfurization of fuel gases. Bissett, L.A. To Dept. of Energy. 1990. Filed date 31 Jul 1990. USA Patent patent application 7-560,666. 24p. Sponsored by U.S. DOE Fossil Energy. Order Number DE92003827. Source: OSTI; NTIS; GPO Dep.

The present invention is directed to a method and apparatus for removing sulfur values from a hot fuel gas stream in a fluidized bed contactor containing particulate sorbent material by employing a riser tube regeneration arrangement. Sulfur-laden sorbent is continuously removed from the fluidized bed through a stand pipe to the riser tube and is rapidly regenerated in the riser tube during transport of the sorbent therethrough by employing an oxygen-containing sorbent regenerating gas stream. The riser tube extends from a location below the fluidized bed to an elevation above the fluidized bed where a gas-solid separating mechanism is utilized to separate the regenerated particulate sorbent from the regeneration gases and reaction gases so that the regenerated sorbent can be returned to the fluidized bed for reuse. 3 figs., 1 tab.

0105 Products and By-Products

Refer also to citation(s) 6122, 6125, 6126

0106 Properties and Composition

Refer also to citation(s) 6102, 6104, 6109, 6110, 6119, 6122, 6175, 6176, 6188, 6190, 6193, 6257, 6996

6199 (CONF-910571–, pp. 186-198) **Determination and nature of water in low rank coals.** Lynch, L.J. (CSIRO Div. of Coal and Energy Technology, North Ryde (Australia)); Barton, W.A.; Webster, D.S. North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. [1991]. From 16. biennal low-rank fuels symposium; Billings, MT (United States); 20-23 May 1991. In *Proceedings of the sixteenth biennial low-rank fuels symposium.* 535p. Order Number DE92002606. Source: OSTI; NTIS; INIS.

The nature of water associated with coal is discussed and the concept of interacting water considered. Adopting a definition for interacting water as that having properties modified from those of bulk water, the criterion for its assessment is that it does not fuse near 273 K. It is recognized that the modification of interfacial water is a consequence of water-coal molecular interaction and that a further consequence of these interactions is likely to be some modification to the molecular properties of the coal itself. A refined method based on proton nuclear magnetic resonance (^{1}H NMR) measurements is described for characterizing water-substrate systems and in so doing accurately determining the saturation water content or maximum water binding capacity of the substrate. The method also provides useful data on the extent to which the substrate molecular structure is destabilized or plasticized by its exposure to water. The procedure is successfully applied to a high inertinite coal with high affinity for water.

6200 (CONF-910571–, pp. 199-215) **Digital scanning electron microscopy techniques for the characterization of coal minerals and coal ash.** Steadman, E.N. (Univ. of North Dakota, Grand Forks (United States)); Benson, S.A.; Zygarlicke, C.J. North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. [1991]. From 16. biennal low-rank fuels symposium; Billings, MT (United States); 20-23 May 1991. In *Proceedings of the sixteenth biennial low-rank fuels symposium.* 535p. Order Number DE92002606. Source: OSTI; NTIS; INIS.

The transformations of inorganic coal constituents which lead to ash deposition in combustion systems are extremely complex. Over the course of the past several years, significant advancements have been made in the understanding of ash formation and deposition that have aided in developing advanced methods of prediction. This has been the result of the application of computer-controlled deposits. The CCSEM technique is a significant advancement over currently used ASTM methods since it determines the size, association, and composition of mineral components in coal. Because of the growing acceptance and widespread use of CCSEM by the coal combustion community, an effort is being made for standardization. Researchers at the Energy and Environmental Research Center (EERC) of the University of North Dakota are presently working toward standardization and, ultimately, ASTM acceptance of the method. In addition, the development of advanced computerized methods to predict ash behavior in combustion systems utilizes CCSEM and other techniques to characterize the coal and coal ashes. This paper describes the methods used at EERC for characterization of the materials involved in ash deposition. Data produced by these techniques have provided insight into the intricate mechanisms of ash-deposit formation. The results and interpretations made from these techniques are compared to those based on ASTM ash analysis in order to demonstrate the utility of the techniques used at EERC.

6201 (CONF-910571–, pp. 501-510) **Use of on-line analyzers for sodium determination in lignite.** Devins, D.W. (Scan Technologies, Inc., York, PA (United States)). North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. [1991]. From 16. biennal low-rank fuels symposium; Billings, MT (United States); 20-23 May 1991. In *Proceedings of the sixteenth biennial low-rank fuels symposium.* 535p. Order Number DE92002606. Source: OSTI; NTIS; INIS.

It is well known that high sodium levels in carbonaceous fuels produce significant fouling problems in utility boilers. The method currently used to insure a low sodium feed is to blend carefully fuels from several different sources for which the sodium content is known from core samples or historical information. This paper describes measurements made with an on-line nuclear analyzer to determine the feasibility of measuring the sodium content of a North Dakota lignite in a timely fashion. The results indicate that a fifteen minute measurement time is sufficient to characterize the sodium content quite well. The range of sodium in the lignite was from 0.21 to 11.18% in ash. The ash range was 5.09 to 9.90% as received. For 22 samples the analyzer achieved a standard error of 0.055% Na_2O in coal and 0.63% Na_2O in ash.

6202 (CONF-910571–, pp. 511-534) **Characterization of hydrothermally and evaporatively dried coals and char products from Usibelli subbituminous 'C' coals.** Rao, P.D. (Univ. of Alaska, Fairbanks (United States)); Walsh, D.E.; Willson, W.; Li, Y.F. North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. [1991]. From 16. biennal low-rank fuels symposium; Billings, MT (United States); 20-23 May 1991. In *Proceedings of the sixteenth biennial low-rank fuels symposium.* 535p. Order Number DE92002606. Source: OSTI; NTIS; INIS.

The Mineral Industry Research Laboratory's (MIRL) near term goals for this project, which has now been completed, were (1) develop data on the responses of Alaskan coals to advanced drying/pyrolysis processes; (2) assess the stability of the dried/pyrolyzed products towards moisture readsorption, fines production and oxidation (an estimation of reactivity and tendency for spontaneous combustion) as a function of the process and operating parameters; and (3) reassess transportation requirements and costs based on altered coal properties. The candidate coal for this test work was subbituminous 'C' coal from the Usibelli Coal Mine, Healy, Alaska; chosen due to existing domestic and export markets, its environmental quality, and its association with Alaska's developed transportation infrastructure. Two high temperature drying/pyrolysis processes and one hydrothermal process were investigated: the Western Research Institute process; the Coal Technology Corporation process; and the Hydrothermal Drying process, or Hot Water Drying.

6203 (CONF-9106303–, pp. 1-2) **Coalification by clay-catalyzed oligomerization of plant monomers.** Orchin, M. (Univ. of Cincinnati, OH (United States)); Wilson, R.M. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-88PC88931. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objective is to demonstrate that structures shown to be characteristic of low rank coals can be generated from C_3-C_6 units (e.g., essential plant oils, etc.) by radical-cation and acid catalyzed reactions promoted by smectic clays such as montmorillonite. It has been demonstrated that polycyclic compounds and several naturally occurring and important lignan structures (e.g. galbulin and podophylloyoxin) can be generated from C_3-C_6 precursors such as eugenol, isoeugenol, and cinnamates. The work may shed considerable light on the biogeogenesis of low rang coals. There is increasing evidence that coal has a macromolecular structure. It is useful therefore to (1) identify possible monomeric units (2) demonstrate the kinds of organic chemical reactions that convert these monomers to polycyclic oligomers (3) identify possible naturally occurring catalysts that may be responsible for such reactions. Finally if one can understand the nature of the oligomerization it is possible to find new ways of depolymerizing the coal macromolecule.

6204 (CONF-9106303–, pp. 3-6) **Spin-mapping of coal structures with ESE and ENDOR.** Belford, R.L. (Univ. of Illinois, Urbana (United States)); Clarkson, R.B. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-88PC88921. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The goal of this work is to develop nondestructive methods to determine the atomic and molecular structures present in the organic (maceral) components of whole coal and coal products. Through work on model compounds such as benzothiophene, dibenzothiophene and thianthrene, the authors have developed an interpretation for the ENDOR spectra of heteroatomic conjugated aromatic radicals including both the g-anisotropy and hyperfine interactions. This analysis makes use of the concept of orientation selection in the ENDOR spectra, and applies the 2-dimensional ENDOR technique with simulation analysis to disordered aromatic systems. Finally, the authors have started two exploratory extensions - (1) the combination of high-frequency EPR and ENDOR and the utility of this combination for the study of fossil fuels, and (2) the use of ESE-determined relaxation times and EPR-determined signal strengths, linewidths, and line shapes to study surface properties of coals and chars, in particular their response to oxygen.

6205 (CONF-9106303–, pp. 7-8) **^{31}P NMR analysis of coal moieties bearing -OH, -NH and -SH functions.** Verkade, J.G. (Iowa State Univ., Ames (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-88PC88923. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objective is to develop heteronuclear NMR reagents for the identification and quantitation of labile hydrogen functional groups in liquid and solid coal materials. Two chlorophospholanes, $ClP(OCMe_2)_2$ and $ClP(SCH_2)_2$ have been synthesized as ^{31}P-containing NMR reagents and the author has demonstrated them to be useful in the identification and quantitation of phenols in coal pyrolysates. A serendipitous discovery made during the course of this work led to the development of $Ph_2(O)PCl$ as an advantageous ^{31}P NMR tagging reagent for the analysis of moisture in coals (and other pyridine-extractable solids). A variety of ^{119}Sn NMR tagging reagents have been evaluated for their efficacy in identifying and quantitating labile hydrogen functional groups found in coal materials. While several of these reagents appear promising there is a persisting problem with concentration dependence of the ^{119}Sn chemical shifts of the derivatized species, owing to equilibria involving coordination of a solvent molecule to the tin (to render it five-coordinate) and dimerization of the derivatized species. The author anticipates that this problem will be solved by the robustly chelated five-coordinate tin reagent shown which he has recently synthesized. Since platinum(II) readily coordinates organosulfur molecules, complexes of this metal ion are being investigated for their utility in identifying organosulfur forms in coal materials.

6206 (CONF-9106303–, pp. 9-11) **Formation and retention of methane in coal.** Hucka, V.J. (Univ. of Utah, Salt Lake City (United States)); Bodily, D.M. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-88PC88939. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The methane content of coal seams in Utah and Colorado will be measured in situ as well as in the laboratory and correlated with the geological and geochemical history of the seams and surrounding strata. Chemical and physical properties will be measured in the laboratory for coals that contain methane and coals of similar rank which do not contain methane. Methane yields on pyrolysis will be used to measure the propensity of coals to form additional methane. Methane formation and retention will be interpreted in terms of the physical and chemical properties of the coal and the chemical and geological history of the coal seam. Eleven coal samples have been collected, 8 from the Book Cliffs and 2 from the Wasatch Plateau fields of Utah and 1 from Colorado. All of the samples come from gassy seams, except for the two from the Wasatch Plateau field. Ultimate, proximate and other analysis has been performed for each of these coals. Helium densities were also measured. Permeabilities have been measured for selected samples. Dipolar dephasing carbon-13 nuclear magnetic resonance spectroscopy measurements have been performed on each of these samples. Types of aliphatic and aromatic carbons were determined for each sample. The coal samples have been pyrolyzed at 12C/min up to 900C to determine the propensity for additional methane formation. The formation of carbon dioxide, carbon monoxide, hydrogen, ethane and ethylene were also measured during pyrolysis. This study will provide information on the interaction of methane and coal that will be useful in the design of methane recovery schemes.

6207 (CONF-9106303–, pp. 12-13) **Permeability changes in coal resulting from gas desorption.** Levine, J.R. (Univ. of Alabama, Tuscaloosa (United States)); Johnson, P.M. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-89PC89764. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The principal objective of this research is to test the hypothesis that volumetric shrinkage of coal during desorption of occluded gases (particularly CH_4) can result in a net increase in the permeability through natural fractures underground. Testing of this hypothesis for a variety of US coal basins involves four tasks: (1) characterization of coal composition, (2) estimation of mechanical strength and elasticity, (3) measurement of sorption/desorption isotherms, and (4) determination of volume changes during sorption/desorption. Samples have been collected at field localities in Illinois basin (Illinois), Black Warrior basin (Alabama), and San Juan basin (Colorado). Additional coals selected from the DESC sample bank at Penn State, represent the Northern and Central Appalachian basins. Specimen preparation procedures involve slabbing, polishing, and grinding to provide suitable representative samples controlling for variations in petrographic composition. A high pressure microbalance sorption apparatus has been assembled to precisely measure weight changes of coal during gas sorption. The present configuration is capable of 1,200 psi and allows resolution of weight changes as small as 1 microgram on a sample as large as 100 mg. Measurement noise arises from turbulence, due in part to adiabatic heating or cooling of gas during changes in pressure. Sorption-related swelling and shrinkage is being measured with strain gages affixed to thin wafers of coal. Preliminary results show that sorption capacity and swelling both decrease with rank, passing through a minimum around high volatile A bituminous rank, before increasing again.

6208 (CONF-9106303–, pp. 14-15) **Basic properties of coals and other solids.** Arnett, E.M. (Duke Univ., Durham, NC (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-89PC89780. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objective is to make a rigorous thermodynamic evaluation of the physical/chemical interactions of a variety of acids with several clearly defined solid bases as a means towards characterizing complex solids such as coals in terms of their acid-base properties. The first eighteen months of the project have concentrated on interactions of the following solids with a variety of acids covering a wide range of strengths from acetic to trifluoromethanesulfonic acid and also boron trichloride. Slurries of polyvinylpyridine in acetonitrile were compared with corresponding solutions of pyridine as a homogeneous analog. An excellent correlation of the heats of interaction for the two systems with thirteen of the acids described above demonstrated the feasibility of comparing solid bases with carefully chosen homogeneous analogs. An attempt to study the behavior of silica as a solid base through its interaction with the above series of acids led to the unexpected and surprising conclusion that silica is such a powerful hydrogen bond donor that it actually interacts with the whole series of carboxylic and sulfonic acid resins as though they were bases. With this background the heats of interaction of samples of Exxon Rawhide subbituminous coal and Illinois #6 subbituminous (Argonne Coal Bank) were compared using twelve carboxylic and sulfonic acids. Although no general correlation was obtained, fairly good correlations were found for the interactions of a series of aliphatic acids, and another for a series of aromatic acids implying differential behavior involving π-π interactions. Again good correlations were found between the behavior of the acids with polyvinylpyridine and with the two coal systems.

6209 (CONF-9106303–, pp. 20) **Novel technique for coal pyrolysis and hydrogenation product analysis.** Pfefferle, L.D. (Yale Univ., New Haven, CT (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-89PC89767. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The overall objective of this study is to establish vacuum ultraviolet photoionization-MS and VUV pulsed EI-MS as useful tools for a simpler and more accurate direct mass spectrometric measurement of a broad range of hydrocarbon compounds in complex mixtures for ultimate application to the study of the kinetics of coal hydrogenation and pyrolysis processes. The VUV-MS technique allows ionization of a broad range of species with minimal fragmentation. Many compounds of interest can be detected with the 118 nm wavelength, but additional compound selectivity is achievable by tuning the wavelength of the photo-ionization source in the VUV. The microjet reactor coupled to a VUV photoionization time-of-flight mass spectrometer has been used to obtain species measurements for high temperature pyrolysis of ethyl acetylene, butadiene, cyclohexane, benzene and toluene. Using this technique, intermediate species profiles of both stable and labile product masses were obtained for analysis of the pyrolysis pathway. Fragmentation was minimized due to the nature of the ionization, yielding predominantly molecular ions. This allows the study of reaction pathways in complex high temperature systems where both sampling and detection challenges are severe. This was true even for the worst case of cyclohexane where fragmentation of the parent fuel was appreciable. In the presentation the author discusses the results from benzene and cyclohexane pyrolysis and the work with development of correlations for VUV photoionization yields based on PES data.

6210 (CONF-9106303–, pp. 21-22) **Molecular accessibility in solvent swelled coal.** Kispert, L.D. (Univ. of Alabama, Tuscaloosa (United States)); Spears, R.; Piekara-Sady, L. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-90PC90284. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

It is the objective of this research to determine catalyst accessibility in Argonne Premium Coal Samples (APCS) upon swelling in polar, basic solvents before and after moisture loss. This can be obtained using an EPR technique that the authors have developed involving various nitroxide spin probes of different shapes or sizes diffused into coal samples. The results are consistent with SANS, DRIFT and NMR relaxation measurements of pore structure as a function of swelling solvents. The advantage of the EPR method is that it permits molecules of selected shape and size to be used as probes of accessible regions of the coal, thus providing information on the importance of molecular shape. The conversion of coal by an economically feasible catalytic method requires the catalyst to diffuse into the coal sample so that hydrogenation catalysis can occur from within as well as the normal surface catalysis. Thus an estimate of the size and shape of the pores in the coal before and after swelling with different solvents is needed so that an optimum sized catalyst will be used. The use of nitroxide spin probes with swelling solvents is a simple way in which to gain an understanding of the pore structure of coals and how it changes in the presence of swelling solvents. Coal contains significant quantities of spherically shaped pores increasing with decreasing rank. If coal is mildly swelled with nitrobenzene, the number of spherically shaped pores increases. A ssolvent polarity increases, such as with pyridine or as swelling temperature increases pores become elongated as evidenced by a decrease in the number of spherically shaped pores and a similar increase in the number of elongated pores. Finally, regardless of the swelling conditions, the pore structure of high rank coals changes very little.

6211 (CONF-9106303–, pp. 23-24) **Advanced NMR approaches in the characterization of coal.** Maciel, G.E. (Colorado State Univ., Fort Collins (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-90PC90290. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The analytical characteristics of the three Argonne Premium coals 801, 601 and 501 have been examined by magic-angle spinning (MAS) ^{13}C NMR, using large samples (2.5 cm^3). This study was based on experiments with ^{13}C magnetization generated by both cross polarization (CP) and by 90° single-pulse (SP) approaches. Various ^{13}C-based relaxation measurements were made. Using the Delrin ^{13}C signal of the Delrin/zirconia spinner as a built-in intensity reference, spin counting was carried out. It was determined that the single-pulse magic-angle spinning (SP-MAS) ^{13}C approach accounts for about 80%, and that the customery cross-polarization magic-angle spinning (CP-MAS) technique accounts for only about 50% of the carbon known to be in each sample; however, a CP-MAS approach that incorporates a better $T_{1\rho}^{H}$ determination accounts for more than 80% of the carbons. Dipolar-dephasing ^{13}C NMR studies provide a measure of the contributions of proton-bearing and non-proton-bearing carbons in the three coals and the fraction of aroamtic or aliphatic carbons that are proton-bearing. The attractiveness and utility of large-volume ^{13}C MAS approaches in the analysis of coal are demonstrated. Although useful results can be obtained via ^{13}C CP-MAS experiments (if one carries out the proper characterization of CP dynamics), the SP-MAS approach with large samples is more straightforward.

6212 (CONF-9106303–, pp. 41-42) **A new model of coal-water interactions and relevance for dewatering.** Suuberg, E.M. (Brown Univ., Providence, RI (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-90PC90308. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objectives are to (1) develop a quantitative theory of moisture retention in coal, based upon solvent swelling theory and (2) use this understanding to design new coal dewatering strategies. The principal accomplishment at this early stage of the project has been the completion of the review of swelling mechanisms of coals in the presence of specifically interacting solvents. The author feels that a new, fundamentally sound understanding of these swelling phenomena has been developed, one that challenges a significant number of earlier theories of moisture retention in coals as well as theories of organic solvent swelling of coals.

6213 (CONF-9106303–, pp. 43-44) **Oxidation of coal and coal pyrite: Mechanisms and influence on surface characteristics.** Doyle, F.M. (Univ. of California, Berkeley (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-90PC90287. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objective of this research is to develop a mechanistic understanding of the oxidation of coal and coal pyrite, and to correlate the intrinsic physical and chemical properties of these minerals, along with changes resulting from oxidation, with those surface properties that influence the behavior in physical coal cleaning processes. The results will provide fundamental insight into oxidation, in terms of the bulk and surface chemistry, the microstructure, and the semiconductor properties of the pyrite. Preliminary work has been done on Illinois No. 6 coal, to learn standard preparation methods and analytical techniques (crushing, grinding, sizing, storage, proximate, ultimate and sulfur analysis), to ensure that the studies are directly comparable with others. The coal has been characterized by Fourier transform infrared spectroscopy, using a reflectance cell, BET analysis and electrochemical methods, to master these techniques. Dry thermal oxdiation tests, and wet oxidation with hydrogen peroxide and aqueous ferric chloride have been done.

6214 (CONF-9106303–, pp. 45-46) **Pyrite surface characterization and control for advanced fine coal desulfurization technologies.** Xianghuai Wang (Univ. of Kentucky, Lexington (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-90PC90295. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objective of this project is to conduct extensive studies on the surface reactivity of pyrite by using electrochemical, surface spectroscopic analysis, potentiometric and calorimetric titration, and surface hydrophobicity characterization techniques and to correlate the alteration of the coal-pyrite surface with the efficiency of pyrite rejection by flotation and oil agglomeration. The products as well as their structures, the mechanism and the kinetics of the oxidation of coal-pyrite surfaces and interactions with various chemical reagents will be systematically studied and compared with that of mineral-pyrite and synthetic pure pyrite to determine the correlation between the surface properties and the bulk physical and chemical properties and impurities. Methods and types of coal being used in the study are described. Results to date are discussed.

6215 (CONF-9106303–, pp. 47-48) **A rheometer for measuring the material moduli for granular solids.** Rajagopal, K.R. (Univ. of Pittsburgh, PA (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-90PC90306. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The authors have proposed building an orthogonal rheometer which consists of two disks rotating with the same angular speed about distinct axes. By measuring the forces and the torque acting on the top and bottom disks and correlating them with the theoretical expressions for the tractions and moment they can characterize the properties of the material that is placed between the disks. The device when built will be able to characterize the material properties of granular materials like coal and also coal slurries. Understanding the properties of such materials will go a long way in the design of bins, hoppers, silos, hydrocyclones and combustors, and in improving their reliability and performance.

6216 (CONF-9106303–, pp. 51-52) **Effects of light metal compounds on coal and carbon gasification.** Low, M.J.D. (New York Univ., NY (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objective is to obtain direct information by infrared spectroscopy about the functional groups present when coals are pyrolyzed and oxidized, and specifically how light metal compounds affect these processes. The pyrolyses of model materials (cellulose, lignin and sucrose) and of three different coals, the oxidations of the pyrolyzates, and the effects of sodium and potassium salts on these processes, have been studied in detail. Potassium has a profound effect on the conversion mechanisms. Infrared Fourier transform photothermal beam spectroscopy has been successfully applied to the study of coals. The series of spectra of sodium- or potassium-impregnated coals provide detailed information about functional groups which are present, formed, and/or altered during coal pyrolysis and oxidation.

6217 (CONF-9106303–, pp. 16-17) **Single electron chemistry of coals.** Larsen, J.W. (Lehigh Univ., Bethlehem, PA (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

There are two objectives concerning the native free radicals in coal. They are: (1) to determine whether the native free radicals in the Argonne coals are sufficiently reactive to initiate the polymerization of 4-vinyl pyridine; (2) to attempt to remove the native radicals from coal by their reaction with N, N′-Diphenyl-p-phenylene diamine (DPPD). Another objective, which does not involve coals native radicals, is to determine the ability of coals to participate in charge transfer interactions. This will be done by depositing tetracyanoquinodimethane (TCNQ) and tetracyanoethylene (TCE) in the coals and studying their IR spectra. The ESR spectra of the resulting coal-electron acceptor system will also be obtained and evaluated. Results to date are described for both studies. It has been demonstrated that the native free radicals in coal are essentially unreactive and need not be considered as active participants in most reactions of coals. Coals readily form extended electronic valence band structures when good electron acceptors are added.

6218 (CONF-9106303–, pp. 119-120) **Configurational diffusion of coal macromolecules.** Guin, J.A. (Auburn Univ., AL (United States)); Curtis, C.W.; Tarrer, A.R. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-86PC90504. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objective is to learn more about how coal macromolecules, e.g., asphaltenes, diffuse through small pores. This diffusion rate is dependent on the molecule size, shape, and pore geometry. This problem has applications in catalysis. The bulk and effective diffusivities of coal macromolecules were measured using the diaphragm-cell technique with track-etched polyester membranes, and the relationship between effective diffusivities of coal macromolecules and pore size of a membrane was investigated, in order to obtain fundamental information concerning configurational diffusion phenomena occurring in coal liquefaction catalysts. The coal macromolecules were prepared from a sample collected from the deashed residue stream of the ROSE-SR unit at the Wilsonville coal liquefaction pilot plant (Wilsonville, Alabama), which was running Illinois No. 6 coal. The track-etched polyester membranes were prepared from irradiated polyester film using optimum etching conditions found in the current study. During the experiments, gel permeation chromatography was used to characterize the coal macromolecules and to analyze the diffusion experimental results. The experimental data were analyzed for six coal macromolecule fractions of narrow molecular size range, which were defined in the chromatogram.

6219 (CONF-9106303–, pp. 134-135) **Coal plasticity at high heating rates and temperatures.** Howard, J.B. (Massachusetts Inst. of Tech., Cambridge (United States)); Peters, W.A. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-89PC89773. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objective is to obtain improved, quantitative understanding of the transient plasticity of softening coals under high heating rates and other reaction and pretreatment conditions of scientific and practical interest. To these ends, the softening and resolidification behavior of two US bituminous coals will be measured with a rapid-heating, fast response, high-temeprature coal plastometer. Apparent viscosity, softening temperature, plastic period, and resolidification time will be measured for molten coal as a function of independent variations in reaction conditions (e.g. temperature, heating rate). Intra-coal inventory and molecular weight distribution of pyridine extractables will also be measured using a rapid quench, electrical screen heater coal pyrolysis reactor. The yield of extractables is taken as representative of the intra-coal inventory of plasticing agent (metaplast) within the coal at the instand of quenching. Coal plasticity kinetics will be mathematically modeled from generation and depletion rates of extractables, by taking advantage of a correlation between the viscosity of a suspension and the concentration of deformable medium (here extractables) in that suspension.

6220 (CONF-9106303–, pp. 139-140) **Equilibrium and volumetric data and model development of coal fluids.** Robinson, R.L. Jr. (Oklahoma State Univ., Stillwater (United States)); Gasem, K.A.M. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-90PC90302. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The specific objectives of the work proposed herein include: development of an experimental facility having the capability to provide data on equilibrium phase compositions (solubilities) and liquid densities, and doing so with greater accuracy and speed than the authors' previous facility; measurement of equilibrium phase properties for systematically-selected mixtures - specifically those containing important solute gases (such as hydrogen, carbon monoxide, carbon dioxide, methane, ethane, carbonyl sulfide, ammonia) in a series of heavy paraffinic, naphthenic and aromatic solvents (e.g., n-decane, n-eicosane, n-triacontane, n-tetracontane; cyclohexane, decalin, perhydrophenanthrene, perhydropyrene; benzene, naphthalene, phenanthrene, pyrene); testing/development of correlation frameworks for representing the phase behavior of fluids of the type encountered in coal-conversion processes; and generalization of parameters in the correlation frameworks to enable accurate predictions for systems of the type studied, permitting predictions to be made for systems and conditions other than those for which experimental data are available. The ultimate goal of this work is to improve the abilities of predictive models for representation of vapor-liquid phase equilibria in mixtures typical of those encountered in production and processing of coal-derived fluids. Since accurate prediction of such phase behavior is critical to the design of all steps in the process in which multiple phases occur, adequate models for phase behavior predictions are of value in many process design and optimization calculations.

6221 (DOE/ET/10815–171) **A study of permeability and porosity in pulverized coal.** Pace, S.L. Jr.; Schmidt, H.J. Tennessee Univ., Tullahoma, TN (United States). Space Inst. Dec 1991. 52p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC02-79ET10815. (UTSI–91-03). Order Number DE92004039. Source: OSTI; NTIS; GPO Dep.

The purpose of this research was to experimentally investigate the relationship between porosity and permeability in pulverized coals. Permeability is defined as the ease with which a fluid passes through a porous medium and is a critical characteristic in the dense phase pneumatic transport of pulverized coal. Porosity is relative volume of the interparticle voids in comparison with the actual solid particulate volume. Porosity can be measured in both static and dynamic situations while permeability is measurable only in the static state and is dependent on particle size, size distribution, state of compaction and porosity. (VC)

6222 (DOE/PC/79925–T1) **Chemical characterization of the surface sites of coal: Final report.** Dwight, D.W.; Lloyd, T.B.; Riddle, F.L. Jr.; Cole, D.A. Lehigh Univ., Bethlehem, PA (United States). Dept. of Chemistry. Apr 1991. 41p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-87PC79925. Order Number DE92000037. Source: OSTI; NTIS; GPO Dep.

This report contains a method for determining the van der Waals and acid-base contributions to the overall ^{31}P chemical shifts ($\Delta\delta^d$ and $\Delta\delta^{ab}$) and to the Acceptor Numbers (AN^d and AN^{ab}) of the Meyer and Gutmann two-component systems, and to illustrate the method with experimental results for thirty-two liquids. 9 refs., 9 figs., 6 tabs.

6223 (DOE/PC/79929–13) **NO-char reactions: Kinetics and transport aspects: Final technical report.** Suuberg, E.M.; Calo, J.M.; Teng, Hsisheng; Lilly, W.D. Brown Univ., Providence, RI (United States). Div. of Engineering. Jul 1991. 215p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-87PC79929. Order Number DE91018978. Source: OSTI; NTIS; GPO Dep.

The reaction chemistry of NO with carbons is quite complex. This study details many different aspects of this chemistry. The choice was made to study the reaction chemistry using carbons derived from phenolic resins. These chars are microporous and have porosity characteristics similar to those of coal chars, but have the advantage that they are relatively free of potentially catalytic impurities. The results have been noted to be quite similar to results obtained on a variety of very different carbons, as reported in the literature. The reaction behavior was studied over a range of NO pressures up to 10.1kPa, and at temperatures between 323K and 1073K. The reaction behavior is an extremely sensitive function of temperature. 87 refs., 51 figs., 26 tabs. (VC)

6224 (DOE/PC/88921–8) **Spin-mapping of coal structures with ESE and ENDOR: Eighth quarterly (second annual) report.** Belford, R.L.; Clarkson, R.B. Illinois Univ., Urbana, IL (United States). 1 Sep 1990. 46p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-88PC88921. Order Number DE92004498. Source: OSTI; NTIS; GPO Dep.

A nondestructive method to determine the atomic and molecular structures present in the organic (maceral) components of whole coal and coal products has been sought for many years. This program of research is designed to address that analytical need by applying advanced electron magnetic resonance techniques to the determination of coal molecular structure. Structural information has be obtained by using the naturally occurring unpaired electrons in coal as "observation posts" from which to survey neighboring atoms through the electron-nuclear hyperfine interaction. Such an overall approach has been termed ELECTRON SPIN MAPPING of coal structure. New techniques like 2-dimensional ENDOR and ESE spectroscopies and multifrequency EPR, including the world's first S-band ESE spectrometer and one of the first W-band instruments, which we have developed in our laboratory, were employed in the determination. The materials studied were well separated macerals obtained by density gradient centrifugation techniques from Illinois #6 coals, a well as whole Illinois #6, #5, and Argonne Premium Sample Coals. model compounds, chosen to represent molecular structures typical of those believed to exist in coal also were studied by the various electron magnetic resonance (EMR) methods. Utilizing the various EMR methods available in our laboratory, we studied approaches to determine parameters that direcly reflect the atomic and molecular structure of coal. The naturally occurring unpaired electrons in coal were utilized as probes of their local environment, which they reflect through hyperfine interactions with neighboring $1 > 0$ nuclei (eg, ^{1}H, ^{13}C).

6225 (DOE/PC/88924–13) **Thermodynamics of the solvent swelling of coal: Final technical report, September 1, 1988–August 31, 1991.** Green, T.K. Western Kentucky Univ., Bowling Green, KY (United States). Center for Coal Science. 1991. 91p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-88PC88924. Order Number DE92005350. Source: OSTI; NTIS; GPO Dep.

The focus of this study was on the thermodynamics of the solvent swelling of coals. Specifically, a vapor pressure method was employed to evaluate Flory interaction parameters for coal-benzene systems. In addition, heats of dilution were determined for coal-pyridine systems using the same technique. The approach is unique in that coal extracts are the focus of the experiments, with the idea that more reliable thermodynamic information can be obtained on the uncrosslinked, soluble fraction of coal as opposed to the crosslinked, insoluble fraction. (VC)

6226 (DOE/PC/88939–14) **Methane formation and retention in coal: Quarterly technical progress report, July 1, 1991–September 30, 1991.** Hucka, V.J. Utah Univ., Salt Lake City, UT (United States). Dept. of Mining Engineering. [1991]. 28p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-88PC88939. Order Number DE92004524. Source: OSTI; NTIS; GPO Dep.

The methane content of coal seams in Utah and Colorado are measured in situ as well as in the laboratory and correlated with the geological and geochemical history of the seams and surrounding strata. Chemical and physical properties are measured in the laboratory for coals that contain methane and coals of similar rank which do not contain methane. Methane yields on pyrolysis are used to measure the propensity of coals to form additional methane. Methane formation and retention will be interpreted in terms of the physical and chemical properties of the coal and the chemical and geological history of the coal seam.

6227 (DOE/PC/89785–8) **The single electron chemistry of coals, July 1, 1991–September 30, 1991.** Larsen, J.W.; Eskay, T.P. Lehigh Univ., Bethlehem, PA (United States). Dept. of Chemistry. [1991]. 10p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-89PC89785. Order Number DE92004525. Source: OSTI; NTIS; GPO Dep.

The objectives of this work are to investigate and characterize the single electron reactions of alkyl and alkoxy aromatic compounds in order to determine the role these reactions play in the chemistry of coal. (1) Attempts will be made to demonstrate that the radicals from inertinite maceral group will initiate the polymerization of 4-vinylpyridine. (2) The molecule, N, N-diphenylphenylendiamine, will be deposited in coals to characterize their native free radicals. (3) Tetracyanoquinodimethane (TCNQ) and tetracyanoethylene (TCNE) will be used to characterize the numbers and strengths of single electron donors in coals.

6228 (DOE/PC/90176–T55) **Characterization of organic nitrogen in IBCSP coals: Final technical report, September 1, 1990–August 31, 1991.** Kruge, M.A. Southern Illinois Univ., Carbondale, IL (United States). Dept. of Geology. [1991]. 33p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-90PC90176. Order Number DE92004191. Source: OSTI; NTIS; GPO Dep.

The overall objective of this study was to determine the content and distribution of organic nitrogen in a series of IBCSP coals and their isolated macerals. The specific objectives were: to determine the bulk nitrogen contents for coals, isolated macerals, oxidation products and residues, solvent extracts and their liquid chromatographic fractions, and pyrolyzates; to determine the distribution of organic nitrogen in all coal derivatives enumerated in Objective 1 which are Gas Chromatography (GC)-amenable. This will be accomplished by GC-Thermionic Specific Detectors; to determine the molecular structure of the major nitrogen compounds detected in Objective 2, using mass spectrometry.

6229 (DOE/PC/90284–5) **Molecular accessibility in solvent swelled coal: Quarterly report, November 1991.** Kispert, L.D. Alabama Univ., University, AL (United States). Dept. of Chemistry. [1991]. 4p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-90PC90284. Order Number DE92004517. Source: OSTI; NTIS; GPO Dep.

The EPR-spin probe method was used to study the swelling of covalently cross-linked 2%, 4%, 6%, 8% and 12% polystyrene-divinyl benzene copolymers, used as models of APCS coal structural elements. The results were compared with swelling studies on APCS coals and confirmed results showing that coal was polymeric, that it had covalent cross-links increasing with rank, that it was structurally anisotropic, and that its swelling was anisotropic. The low temperature swelling of Argonne Premium Coal Samples using solvents of varying polarity was investigated. The variation in the shape of the pore was followed as a function of temperature and swelling solvent polarity. This change in pore structure was attributed to break-up of the hydrogen bonding network in coal by polar solvents. The modification in pore shape from spherical to cylindrical was attributed to anisotropy in hydrogen bond densities. The structural changes in coal pores that occur when APCS coal is dehydrated prior to swelling with polar solvents has been determined. These changes are different from those that occur in the absence of prior dehydration. Most impressive is the huge change that occurs in lignite coal (Beulah-Zap). It appears that this coal has collapsed upon dehydration preventing any spin probe from being trapped in the dehydrated lignite upon swelling. Various sized probes have been studied. A study on the variation in the hydrogen bonding character of the pore wall as the coals are swelled with various polar solvents has also been completed. A statistical analysis of the data has been completed to determine important trends in the data. 9 refs.

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Refer also to citation(s) 6114, 6127, 6159, 6200, 6261, 6262, 6265, 6270, 6271, 6272, 6273, 6274, 6277, 6278, 6280, 6285, 6552, 6553, 6558, 6562, 6563, 6564, 6565, 6567, 6828, 6829, 6833, 6996, 7681

6230 (ANL/CP-72760) **Combined SO_2/NO_x control using ferrous·EDTA and a secondary additive in a lime-based aqueous scrubber system.** Mendelsohn, M.H.; Livengood, C.D.; Harkness, J.B.L. Argonne National Lab., IL (United States). [1991]. 15p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-31109-ENG-38. (CONF-911226-1: SO_2 control symposium, Washington, DC (United States), 3-6 Dec 1991). Order Number DE92003419. Source: OSTI; NTIS; GPO Dep.

Integration of NO_x control into existing flue-gas desulfurization (FGD) systems addresses site-specific control requirements while minimizing retrofit difficulties. Argonne has studied the use of the metal-chelate additives, such as ferrous·EDTA in various wet FGD chemistries, to promote combined SO_2/NO_x scrubbing. A major process problem is oxidation of the iron to the ferric species, leading to a significant decrease in NO_x-removal capability. Argonne discovered a class of organic compounds that, when used with ferrous·EDTA in a sodium carbonate chemistry, could maintain high levels of NO_x removal. However, those antioxidant/reducing agents are not effective in a lime-based chemistry, and a broader investigation of antioxidants was initiated. This paper discusses results of that investigation, which found a practical antioxidant/reducing agent capable of maintaining NO_x removals of about 50% (compared with about 15% without the agent) in a lime-based FGD chemistry with FE(II)·EDTA. 5 refs., 10 figs.

6231 (CONF-910571-, pp. 155-171) **Recent developments in particulate control with low-rank fuels.** Miller, S.J. (Univ. of North Dakota, Grand Forks (United States)); Laudal, D.L. North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. [1991]. From 16. biennal low-rank fuels symposium; Billings, MT (United States); 20-23 May 1991. In *Proceedings of the sixteenth biennial low-rank fuels symposium.* 535p. Order Number DE92002606. Source: OSTI; NTIS; INIS.

Regulations appear to be focusing on fine particle emissions rather than total mass particulate emissions. There is concern that electrostatic precipitators (ESPs) may not be able to meet potentially stricter finer particle emission standards. A new development in the area of fabric filtration is the use of flue gas-conditioning agents to reduce particulate emissions and pressure drop. Theoretical analysis of the factors that control the size of a baghouse indicates that pulse-jet baghouses can be designed to operate at much higher air-to-cloth ratios than is currently employed. To help optimize performance of both ESPs and baghouses, quantitative characterization of the cohesive properties of fly ash is necessary. Appropriate methods are determination of aerated and packed porosity and measurement of tensile strength as a function of porosity.

6232 (CONF-910571-, pp. 172-184) **Calcium duct injection technology for SO_2 control.** Claussen, R.L. (United Engineers and Constructors Inc., Denver, CO (United States)); Goffredi, R.A.; Martin, C.E. North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. [1991]. From 16. biennal low-rank fuels symposium; Billings, MT (United States); 20-23 May 1991. In *Proceedings of the sixteenth biennial low-rank fuels symposium.* 535p. Order Number DE92002606. Source: OSTI; NTIS; INIS.

To promote the widespread use of coal in an environmentally and economically acceptable manner, the US Department of Energy sponsors a Flue Gas Cleanup Program to develop environmental control technology for coal-fired utility boilers. One of the largest research and development activities occurring in the SO_2 emission control area is the development of duct injection of calcium sorbents. Based on encouraging proof-of-concept test results, the Department of Energy-Pittsburgh Energy Technology Center has funded a multifaceted Duct Injection Technology Development Program. The goal of this program is to develop low-cost SO_2 emission control technology that can be installed on existing coal-fired power plants. Current work is concentrated on developing calcium duct injection technology by late 1992 suitable for retrofitting older plants that were built prior to promulgation of New Source Performance Standards in 1971. This paper reviews results to date under this program, summarizes work still to be done, and presents comparisons of calcium duct injection technology with other related FGD processes. A perspective on how duct injection technology might fit into acid rain compliance strategies is also presented.

6233 (CONF-910571-, pp. 272-283) **'Top-down' BACT analysis - Recommended approach and recent determinations.** Cochran, J.R. (Black and Veatch, Kansas City, MO (United States)); Fagan, M.E. North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. [1991]. From 16. biennal low-rank fuels symposium; Billings, MT (United States); 20-23 May 1991. In *Proceedings of the sixteenth biennial low-rank fuels symposium.* 535p. Order Number DE92002606. Source: OSTI; NTIS; INIS.

New EPA requirements for 'top-down' best available control technology (BACT) analyses have resulted in determinations that require more stringent control technologies. Accordingly, these permit decisions include nitrogen oxide (NO_x), sulfur dioxide, and particulate emission limits significantly lower than applicable New Source Performance Standards. However, with careful consideration of acceptable site-specific impacts, obtaining a reasonable BACT determination is still possible. This paper presents a step-by-step approach for conducting a top-down BACT analysis, and summarizes important considerations that will lead to a more effective BACT analysis. In addition, recent permit decisions regarding NO_x emission rate and control technology requirements for combined cycle combustion turbine and coal fueled power plants are summarized and examined to ascertain the basis for decisions. Guidance from this paper will help applicants in preparing an accurate and comprehensive BACT analysis for their proposed projects.

6234 (CONF-9106303-, pp. 88-89) **Comparative study of the reactions of metal oxides with SO_2 and H_2S.** Sotirchos, S.V. (Univ. of Rochester, NY (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-90PC90301. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The primary objective of this project is the investigation of the effects of pore structure on the capacity of porous metal oxides for removal of gaseous pollutants from flue gases of power plants (SO_2) and hot coal gas (primarily H_2S). The experimental studies will include reactivity evolution studies and pore structure characterization using a variety of methods, and the work will focus on oxides that can react (sufficiently fast) both with SO_2 and H_2S. The author intends to appropriately exploit the differences of the sulfidation and sulfation reactions (for instance, different molar volumes of solid products) to elucidate the dependence of the sorptive capacity of a porous sorbent on its physical microstructure. Experiments have been carried out on the reactivity and pore structure evolution of CaO sorbents during reaction with H_2S. Various mathematical models for gas-solid reactions with solid product were used to theoretically investigate the reactions of limestone calcines with H_2S and zinc oxide sorbents with SO_2 on the basis of past experimental results for the sulfation and sulfidation, respectively, reactions of these sorbents. A detailed analysis of the problem of effective diffusivity measurement using the diffusion-cell method was carried out.

6235 (CONF-9106303–, pp. 143-144) **Plasma assisted NO_x reduction in existing coal combustors.** Yao, S.C. (Carnegie Mellon Univ., Pittsburgh, PA (United States)); Russell, T. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-88PC88932. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objective is to explore the feasibility of using plasma produced chemical radicals to interact with the coal combustion processes to reduce NO_x emissions. A complete analysis of the chemical kinetics of ammonia and the radicals derivaties of ammonia has been performed. Additional species can favorably modify the kinetics to increase radical lifetimes and process efficiency. The chemical model is being altered to model the freezing the reactions by rapid expansion through a nozzle. Modeling of nitrogen plasma injection, unlike ammonia, has been shown to be ineffective chemically and energetically. CMU combustion facility modification has been completed and inductively coupled plasma system has been converted for the present application. A series of tests has been performed which have supported the computational results. Additional methods, and optimization of current methods, are being studied to increase process effectiveness. These results, which are supported by those found at the PETC facility, show that NO_x reduction by the injection of molecular radicals is effective. The reduction is less sensitive to combustion gas temperature and less susceptible to ammonia slip than thermal deNO_x.

6236 (CONF-9106303–, pp. 150-152) **Pulsed electron beam precharger.** Shelton, W.N. (Florida State Univ., Tallahassee (United States)); Finney, W.C. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-89PC89768. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The specific objective of the Pulsed Electron Beam Precharger project is to further develop the technology of efficiently collecting high resistivity fly ash using a two-stage system composed of an electron beam precharger coupled with an electrostatic precipitator. High resistivity fly ash, produced by burning low sulfur coal in power plant and industrial boilers, limits the operating parameters of conventional electrostatic precipitators by initiating debilitating back corona. If the particle charging and collecting functions are optimized separately in a two-stage configuration, higher removal efficiencies can be obtained and the back corona problem can largely be avoided. The process of electron beam ionization of air molecules produces a bipolar plasma of ions and electrons in the precharger. One monopolar fraction (usually negative) is used to charge the dust particles to very high levels nearing the saturation limit. After precharging, the aerosol is removed in a downstream electrostatic collector operated in a back corona-free electrical condition. The superior charging performance of electron beam prechargers is due to the combined effects of space charge enhancement of the charging electric field, and a much superior particle charging by available free electrons. Pulsed operation of the particle charging electric field is the subject of the present contract research. The advantage of pulsing the electric field lies in the fact that pulsed electric fields can be achieved which are much larger than the breakdown electric field for DC operation, provided that the pulse duration is sufficiently short (200 ns). The direct result is an increase in particle charge due to the increase in electric field during the pulse, and an enhancement of the charging field due to ionic space charge which would persist for some time after the pulse in the presence of a DC bias.

6237 (CONF-9106303–, pp. 153-154) **Binding and catalytic reduction of NO by transition metal aluminosilicates.** Klier, K. (Lehigh Univ., Bethlehem, PA (United States)); Herman, R.G. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-89PC89784. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objective is to provide the scientific basis for processes that actively and selectively disproportionate or reduce NO in dilute exhaust streams, as well as in concentrated streams, to N_2. Experimental studies of NO chemistry in transition metal-containing aluminosilicate catalysts will be carried out with the aim of determining the patterns of reactivity in activating NO. Electronic and orbital calculations will be carried out to deduce the chemical rules for NO reduction on non-precious metals. Divalent transition metal exchanged A zeolite samples, including Co(II) exchanged A zeolites having 1.3 and 3.9 Co(II) ions per unit cell, as well as Fe(II), Mn(II), and Cu(II) A zeolites, have been prepared and characterized. A reaction system that is capable of being evacuated and containing an in situ diffuse reflectance cell and a quadrupole mass spectrometer has been assembled and is being used for the NO disproportionation and reduction studies that are being carried out with these zeolites. It has been demonstrated that the ion exchange process can be quantitatively monitored by HR-ESCA analysis. In addition, the valence band spectra, as well as HMO calculations, indicate that there is significant bonding overlap of the 3d orbitals of the Co ions with the zeolite O 2p-based lattice orbitals.

6238 (CONF-9106303–, pp. 155-157) **Molten iron oxysulfide as a superior sulfur sorbent.** Hepworth, M.T. (Univ. of Minnesota, Minneapolis (United States)); Reid, K.J. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-89PC89778. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objective is to examine the thermodynamics and kinetics of the molten phase in the iron-oxygen-sulfur system to determine the optimum operating conditions to run a slagging-desulfurizing burner and to compare the potential for use of this system with lime-based systems for desulfurization. Slagging combustors with injected lime or limestone are being considered as replacements for conventional coal burners. They have advantages in that they can be staged to reduce NO_x and SO_x emissions. Iron oxide, as an alternative to lime or limestone may be effective not only as a desulfurizing agent, but under the right conditions of oxygen potential and after combination with sulfur, the reaction products of coal gases with iron oxide can act as a flux to produce a fluid phase. The thermodynamic conditions for determining the most effective operating conditions of the first stage of a combustor are calculated for several Illinois coals. The conditions which were studied this year include contact of a coal gas with the phase combinations $CaO/CaSO_4$, CaO/CaS, Fe/FeO/Liquid for the temepruture range of 950 to 1,300C.

6239 (CONF-9106303–, pp. 158-159) **Comparison of lime and iron oxide for high temperature sulfur removal.** Reid, K.J. (Univ. of Minnesota, Minneapolis (United States)); Hepworth, M.T. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-89PC89779. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objective is to examine the sulfur removal behavior of both lime and iron oxide sorbents under carefully controlled sulfur and oxygen potentials in a novel double vortex combustor. If iron oxide can be substituted for lime in a multistage burner, then it may be possible to improve the degree of desulfurization which can be accomplished over that encountered with lime as a sorbent. At the same time, a low-melting point slag should be the product which has the potential to be less reactive to atmospheric conditions of water-leaching than calcium sulfide, which would be the product of lime-desulfurization under reducing conditions. A highly sophisticated second hand gas train control system and off gas treatment unit was acquired at a favorable cost and is now installed as part of the overall double vortex burner test rig. A glass burner model has been constructed and has provided many critical insights into flame stability and operating characteristics. A fine particle feeder system has been developed and calibrated for feeding fine taconite concentrate material.

6240 (CONF-9106303–, pp. 162-164) **Synergistic capture mechanisms for alkali and sulfur species from combustion.** Peterson, T.W. (Univ. of Arizona, Tucson (United States)); Shadman, F.; Wendt, J. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-90PC90285. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

It is proposed to conduct a systematic study to elucidate mechanisms governing both the effect of sulfur on the capture of alkali and trace metals on sorbents during combustion, and the converse effect of alkali/trace metals on the capture of sulfur. This study is motivated by existing data which indicate that the speciation of alkali compounds in the gas phase profoundly influences the mechanism of alkali capture on alumino-silicate sorbents, and by results from other laboratories demonstrating enhanced sulfur capture by lime contaminated by alkali or trace metals. The authors propose to utilize these synergistic mechanisms to develop novel bifunctional sorbents, suitable for the simultaneous capture of alkali/trace metals and sulfur during combustion. Such a dual sorbent might be bauxite or alumina impregnated with lime. The research involved bench scale experimental studies, laboratory combustor studies and theoretical modeling to relate the two. Bench scale experiments, utilizing a thermogravimetric furnace, focus on kinetics and mechanisms of alkali/trace metal interactions with individual sorbent flakes under simulated flue gas conditions. Laboratory combustor studies, utilizing a 17kW downflow combustor, focus on synergistic mechanisms as they occur in real, but well defined, combustion environments, with the sorbent in a disperse phase. Additional synergistic effects caused by combustion modifications for NO_x abatement will also be examined. In each case attention is centered on synergistic interactions during condensation and capture on sorbents. Results from this research should lead to novel 'designer' sorbents which will allow coal to be burned with minimum alkali/trace metal, sulfur and nitrogen oxide emissions.

6241 (CONF-9106303–, pp. 167-168) **Anion-exchange resin-based desulfurization process.** Sheth, A.C. (Univ. of Tennessee Space Inst., Tullahoma (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-90PC90309. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

From the economic and environmental viewpoints, it is necessary to regenerate (desulfurize) and recycle the spent alkali metal sorbents (mainly sulfates). The need for a simple, low-cost and readily acceptable sorbent regeneration option to desulfurize such alkali metal sulfates can be satisfied by the anion-exchange resin-based UTSI concept. To date in the project, the following activities have been carried out: completed computer-based literature search and acquired publications of interest; contacted resin manufacturers and suppliers and acquired samples of eleven candidate resins; developed an experimental screening procedure to evaluate candidate resins in relatively easy and quicker (than fixed bed mode) batch mode tests; prepared a schematic of the semi-automated fixed-bed unit and arranged (either salvaged or ordered) for the necessarry parts and components. Results to date are discussed.

6242 (DOE/PC/79861–T1) **Electric Power Research Institute, High-Sulfur Test Center report to the Steering Committee, July 1991.** Electric Power Research Inst., Palo Alto, CA (United States). [1991]. 73p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-87PC79861. Order Number DE92004309. Source: OSTI; NTIS; GPO Dep.

Operation and testing continued this month at the High Sulfur Test Center on the Pilot Wet Scrubber, Mini-Pilot Wet Scrubber and the Spray Dryer Systems. The Pilot continued testing under the High Performance test block program and the Mini-Pilot continued testing under the Formate Forced Oxidation test block. The HSSD testing to investigate the effects that ambient temperature and humidity have on SO_2 removal was completed. Dry alkaline injection testing was started to remove SO_3 and HCl from flue gas which removes visible plumes. Construction upgrades and system shakedown continued on the Cold-Side Selective Catalytic Reduction (SCR) system in preparation for start-up. (VC)

6243 (DOE/PC/81010–T1) **A 12-MW-scale pilot study of in-duct scrubbing (IDS) using a rotary atomizer.** Samuel, E.A.; Murphy, K.R.; Demian, A. General Electric Environmental Systems, Lebanon, PA (United States). Nov 1989. 231p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-85PC81010. Order Number DE92004183. Source: OSTI; NTIS; GPO Dep.

A low-cost, moderate-removal efficiency, flue gas desulfurization (FGD) technology was selected by the US Department of Energy for pilot demonstration in its Acid Rain Precursor Control Technology Initiative. The process, identified as In-Duct Scrubbing (IDS), applies rotary atomizer techniques developed for lime-based spray dryer FGD while utilizing existing flue gas ductwork and particulate collectors. IDS technology is anticipated to result in a dry desulfurization process with a moderate removal efficiency (50% or greater) for high-sulfur coal-fired boilers. The critical elements for successful application are: (1) adequate mixing of sorbent droplets with flue gas for efficient reaction contact, (2) sufficient residence time to produce a non-wetting product, and (3) appropriate ductwork cross-sectional area to prevent deposition of wet reaction products before particle drying is comple. The ductwork in many older plants, previously modified to meet 1970 Clean Air Act requirements for particulate control, usually meet these criteria. A 12 MW-scale IDS pilot plant was constructed at the Muskingum River Plant of the American Electric Power System. The pilot plant, which operates from a slipstrem attached to the air-preheater outlet duct from the Unit 5 boiler at the Muskingum River Plant (which burns about 4% sulfur coal), is equipped with three atomizer stations to test the IDS concept in vertical and horizontal configurations. In addition, the pilot plant is equipped to test the effect of injecting IDS off- product upstream of the atomizer, on $SO_2$and NO_x removals.

6244 (DOE/PC/88850–T5) **Fundamental investigation of Duct/ESP phenomena: 1.7 MW pilot parametric testing results: Topical report No. 2.** McGuire, L.M.; Brown, C.A. Radian Corp., Austin, TX (United States). 22 Jul 1991. 182p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-88PC88850. Order Number DE92002584. Source: OSTI; NTIS; GPO Dep.

Radian Corporation was contracted to investigate duct injection and electrostatic precipitator phenomena in a 1.7-MW pilot plant constructed for this test program. This study was an attempt to resolve previous problems and to answer remaining questions with the technology using an approach which concentrated on the fundamental mechanisms of the process. The goal of the study was to obtain a better understanding of the basic physical and chemical phenomena that control: (1) the desulfurization of flue gas by calcium-based reagent, and (2) the coupling of the duct injection process to an existing ESP particulate collection device. (VC)

6245 (DOE/PC/88852–T4) **Duct injection technology prototype development: Evaluation of engineering data: Topical report No. 2.** United Engineers and Constructors, Inc., Denver, CO (United States). Stearns-Roger Div. Jul 1990. 331p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-88PC88852. Order Number DE92002583. Source: OSTI; NTIS; GPO Dep.

The objective of the Duct Injection Technology Prototype Development Project is to develop a sound design basis for applying duct injection technology as a post-combustion SO_2emissions control method to existing coal-fired power plants. The necessary engineering design and scale-up criteria will be developed for the commercialization of duct injection technology for the control of

SO_2 emissions from coal-fired boilers in the utility industry. The primary focus of the analyses summarized in this Topical Report is the review of the known technical and economic information associated with duct injection technology. (VC)

6246 (DOE/PC/90544–T1) **Healy Clean Coal Project: Technical progress report, quarterly report No. 1 & 2 for the period January–June 1991.** Stone and Webster Engineering Corp., Denver, CO (United States). Sep 1991. 22p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FC22-91PC90544. Order Number DE92002828. Source: OSTI; NTIS; GPO Dep.

The objective of the Healy Clean Coal Project is to demonstrate the integration of an advanced combustor and heat recovery system with both high and low temperature emission control processes. The resulting emission levels of SO_2, NO_x, and particulates are expected to be significantly better than the federal New Source Performance Standards. 3 figs. (VC)

6247 (Juel–2497) **Theoretical investigations on the behaviour of heavy metals in coal-fired power plants.** Angewandte Systemanalyse. Markewitz, P. Forschungszentrum Juelich GmbH (Germany). Programmgruppe Systemforschung und Technologische Entwicklung; Essen Univ. (Gesamthochschule) (Germany). Jul 1991. 186p. (In German). Order Number DE92750201. Source: OSTI; NTIS (US Sales Only).

This study is devoted to a theoretical analysis of the most important parameters having an influence on the trace element emissions from coal-fired power plants. To this end, the flue gas section in a coal-fired power plant is subdivided into the components combustion/boiler, electrostatic precipitator and flue gas desulphurization. These components are then analysed by different models. Besides the retaining of trace elements in ash or slag, especially their accumulation on fly ash particles and the impact on control technologies are analysed. Furthermore, the purification of boiler heating surfaces has been modelled and computations for the element arsenic have been performed. (orig.).

0109 Environmental Aspects

Refer also to citation(s) 6108, 6126, 6239, 6283, 6792, 6805, 7681

6248 (CONF-910571–, pp. 445-446) **Field study of wastes from fluidized-bed combustion technologies.** Weinberg, A. (Radian Corp., Austin, TX (United States)); Holcombe, L.; Butler, R. North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. [1991]. From 16. biennal low-rank fuels symposium; Billings, MT (United States); 20-23 May 1991. In *Proceedings of the sixteenth biennial low-rank fuels symposium.* 535p. Order Number DE92002606. Source: OSTI; NTIS; INIS.

The Department of Energy (DOE) has undertaken a research project to monitor advanced coal process wastes placed in natural geologic settings. The overall objective of the study is to gather field data on the engineering and environmental performance of disposed solid waste from various advanced coal processes. The coal ash from a fluidized-bed combustion unit is being studied as part of the DOE program. The unit is a 110-MW circulating fluidized bed (CFB) at Colorado Ute Electric Association's Nucla Steam Electric Station, which is being demonstrated with the support of the DOE Clean Coal Technology Program. The Electric Power Research Institute is cofunding the study. In June of 1989, a test cell approximately 100 feet square and 8 feet deep was constructed and filled with ash from the Colorado Ute CFB unit. The cell was instrumented with lysimeters and neutron probe access tubes to monitor water flow and leachate chemistry in the ash; groundwater wells and runoff collection devices were installed to determine the effects on groundwater and surface water quality, and a meteorological station was installed to determine the water balance. Additionally, tests are being performed to evaluate the chemical, physical, and mineralogical properties of the solid waste and geologic materials. Results from the first year of monitoring are presented.

6249 (CONF-9106303–, pp. 160-161) **Selenium transformation in coal mine spoils: Its environmental impact assessment.** Atalay, A. (Univ. of Oklahoma, Norman (United States)); Koll, K.J. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-89PC89782. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objectives are to develop an Ion Chromatograph procedure for analysis of selenium; to conduct field lysimetry study to monitor the transformation of selenium from coal mine spoils; and to assess the impact of selenium from coal mine spoils on the environment. The ion chromatograph procedure developed for measuring selenium from water samples was extended to look at selenium in soils and plant materials. The method was also useful in analyzing other anions such as arsenate, aresenite, nitrate, chloride, and sulfate. The Lysimetry set up can be used to study the redox chemistry of other metals in the aqueous soil environment. The environmental impact assessment conducted revealed that selenium and other mobile pollutants may not be a problem in older spoil sites that have equilibrated long enough.

0110 Reserves, Geology, and Exploration

Refer also to citation(s) 6206

0120 Mining

Refer also to citation(s) 6206, 6207, 6288, 6291

6250 (ETDE/JP-mf–2749179) **Handbook of safety technology of coal mines. 1.: Gas-coal dust explosions.** Mining and Material Processing Inst. of Japan, Tokyo (Japan). Mar 1991 101p. (In Japanese). Order Number DE92749179. Source: OSTI; NTIS (US Sales Only).

Of safety technologies of coal mines summarized as a handbook, described is the safety technology on gas-coal dust explosions. Reaction process of the explosion is complicated, and for prevention of explosions, it is necessary not to make explosion limit concentration atmospheres of flammable gases (mostly methane) and coal dust and not to give ignition source energy to them. There are various ignition sources such as blasting, electric spark, static electricity, spontaneous fire, mine fire, friction spark. Ventilation is made as measures against methane gas. Measures against coal dust are prevention of coal dust production, cleaning and removal of sedimentary coal dust, inactivation of coal dust and removal of fire source causing explosion. Measures for prevention of explosion propagation are taken just in case of explosion: rock dust barrier, water barrier, auto water curtain, dense rock dust zones. Some explosion prevention technologies in site and some accidents happened are explained. Furthermore, safety standards are established according to mine safety laws and regulations. 69 refs., 49 figs., 20 tabs.

6251 (ETDE/JP-mf–2749180) **Handbook of safety technology of coal mines. 2.: Gas outburst-rock-burst.** Mining and Material Processing Inst. of Japan, Tokyo (Japan). Mar 1991 145p. (In Japanese). Order Number DE92749180. Source: OSTI; NTIS (US Sales Only).

Of safety technologies of coal mines summarized as a handbook, described is the safety technology on gas outburst-rock burst. The gas outburst is eruption of coal and gas, and indications of danger of the outburst are gas reserves, degrees of stress relaxation of the coal seam ground, etc. Measures against gas outburst are mainly stress relaxation and gas drainage. Measures for gas control are gas drainage made along the coal seam and made vertically through the coal seam, hydraulic fracturing and ground boring. Measures for rock pressure control are advanced drilling of a protective coal seam which is less dangerous from gas outburst, boring for stress relaxation and excavation of pressure release mine roadways. The rock burst is a phenomenon that coal and rocks bound out into the operation space by abrupt fracture of the rock mass caused by rock pressure. In addition to predictions by a geological structure survey and signs of talking and ground swelling, the following are taken up: wide-area control of coal seam rock pressure (improvement of mining methods, pressure release mine roadways), measures for coal seam strengthening (pressure release boring, pressure release blasting, pressure release water-pouring). Some coal mine accidents and prevention measures are explained. 127 refs., 130 figs., 22 tabs.

6252 (ETDE/JP-mf–2749183) **Handbook of safety technology of coal mines. 5.: Ventilation control.** Mining and Material Processing Inst. of Japan, Tokyo (Japan). Mar 1991 69p. (In Japanese). Order Number DE92749183. Source: OSTI; NTIS (US Sales Only).

Of safety technologies of coal mines summarized as a handbook, described is the safety technology on ventilation control. Factors in drawing up a plan for ventilation control are increasing due to the mine structure being deeper, more complicated and larger-sized, increasing gas emission and temperature rises of rock mass. Air flow rate and frictional resistance are calculated by measuring wind velocity, temperature, humidity and ventilating pressure. Various ventilation methods are devised according to the mine structure. Ventilation network of the mine consists of mine roadway, working face, air duct and clearance where leakage flows. The fire escape route must also be considered. The following factors for the ventilation plan should be considered: structure of the ventilation network, pressure loss, features of blowers, natural ventilation pressure, constant-flow airway where constant air flows, and leakage. As a theory of ventilation elucidation, a Hardy-Cross method and a panel point method, which are the succesive approximation method by computer, are explained showing calculation examples. 17 refs., 60 figs., 35 tabs.

6253 (ETDE/JP-mf–2749184) **Handbook of safety technology of coal mines. 6.: Thermal environmental control.** Mining and Material Processing Inst. of Japan, Tokyo (Japan). Mar 1991 55p. (In Japanese). Order Number DE92749184. Source: OSTI; NTIS (US Sales Only).

Of safety technologies of coal mines summarized as a handbook, described is the safety technology on thermal environmental control. Aggravation of the thermal environment at working faces affects health, safety and productivity. What controls capacity of heat dissipation from human body into the exterior is temperature, humidity and wind velocity, and besides, various thermal environment indices for increasing working efficiency are presented. As heat sources, geothermy, heat from machinery, air compression heat and others are cited. Measurements of rock mass temperature and air temperature? humidity and calculation methods of temperature?humidity of air flow are introduced. When the thermal environmental conditions become worse, increasing of air flow rate and mine cooling by refrigerator are usually conducted. However, the most reasonable measures should be taken in view of various points because they are closely related to cost, production and safety. The high temperature problem is apt to occur especially at working faces. Measures against hot water discharge are boring drain, grouting, etc. Cold water spray is also adopted to hot rock mass. Some examples of measures for thermal environmental control are explained. 6 refs., 56 figs., 16 tabs.

0130 Transport, Handling, and Storage

Refer also to citation(s) 6110, 6127, 6202

6254 (CONF-9108127–3) **Boundary conditions for granular flows at randomly fluctuating bumpy boundaries.** Richman, M.W. Worcester Polytechnic Inst., MA (United States). Dept. of Mechanical Engineering. [1991]. 13p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-91PC90185. From 2. U.S.-Japan seminar on micromechanics of granular materials; Syracuse, NY (United States); 4-10 Aug 1991. Order Number DE92004496. Source: OSTI; NTIS; GPO Dep.

In this paper we focus attention on the interactions between rapid flows of identical, smooth spheres that interact with bumpy boundaries through inelastic collisions. The boundaries translate with specified mean velocities, and deviate about the mean with specified fluctuation velocities. Based upon Maxwellian velocity distribution functions that describe the velocities of both the flow particles and boundaries, we calculate the rates at which linear momentum and kinetic energy are exchanged between the two. Using these exchange rates, we write down conditions that ensure that both momentum and energy are balanced at bumpy boundaries. Finally, we employ a constitutive theory that is consistent with these conditions to calculate the granular temperature and solid fraction profiles within a granular material confined between two parallel, bumpy surfaces that randomly fluctuate about zero mean velocity.

0140 Combustion

Refer also to citation(s) 6117, 6127, 6194, 6200, 6246, 6285, 6551, 6552, 6553, 6554, 6556, 6557, 6558, 6559, 6826, 6827, 6828, 6829, 6830, 6831, 6832, 6875, 6876, 7178

6255 (CONF-910571–, pp. 231-246) **Use of hot-water dried subbituminous coal-water slurry in a direct-fired gas turbine.** Wilkes, C. (General Motors Corp., Indianapolis, IN (United States)); Bourke, R.C. North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. [1991]. DOE Contract AC21-86MC23165. From 16. biennal low-rank fuels symposium; Billings, MT (United States); 20-23 May 1991. In *Proceedings of the sixteenth biennial low-rank fuels symposium.* 535p. Order Number DE92002606. Source: OSTI; NTIS; INIS.

This paper summarizes the work sponsored by the Department of Energy (DOE) Morgantown Energy Technology Center (METC) and performed over the past five years aimed at the development of a direct fired, coal-fueled industrial gas turbine in the 3.5 to 5 MW class. Early development tests were performed using deeply cleaned (0.7% ash) bituminous coal-water-slurry (CWS) fuel. This fuel was chosen with the intent of minimizing ash deposition and turbine erosion problems while accepting a projected moderately higher fuel cost. Later, as component technology development improved, the opportunity was taken to explore a wide range of fuels including a subbituminous coal-slurry with increased ash content. The results of bench-scale combustor (6 MMbtu/hour heat input) testing of this fuel were so encouraging that additional tests were run on a full scale, 70 MMbtu/hour nominal heat input combustion system. As a result of these successes, proof-of-concept tests are now in progress using a 3.5 MW industrial gas turbine burning hot water dried subbituminous coal-water slurry supplied by the University of North Dakota Energy Research Center (UNDERC). These tests, and future plans to convert the fuel system to permit the feeding of dry coal, including a dried Powder River Basin coal, are described.

6256 (CONF-910571–, pp. 406-420) **Design and operation of the EERC pilot-scale circulating fluidized-bed combustor.** Henderson, A.K. (Univ. of North Dakota, Grand Forks (United States)); Moe, T.A.; Hajicek, D.R.; Mann, M.D. North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. [1991]. From 16. biennal low-rank fuels symposium; Billings, MT (United States); 20-23 May 1991. In *Proceedings of the sixteenth biennial low-rank fuels symposium.* 535p. Order Number DE92002606. Source: OSTI; NTIS; INIS.

Project CFB was initiated in May 1988 under funding provided from the US Department of Energy (DOE), the Empire State Electric Energy Research Corporation (ESEERCO), Northern States Power Company (NSP), the Electric Power Research Institute (EPRI), Otter Tail Power Company, North Dakota Lignite Research Council, ARCO Coal Company, TU Electric, Consolidated Edison of New York, Premier Refractories and Chemicals, and the University of North Dakota Energy and Environmental Research Center (EERC). The overall goal of the project was to provide a technical basis for assessing the economic and environmental feasibility of circulating fluidized-bed combustion (CFBC) technology, focusing on the effect of system configuration and coal properties on performance. Other underlying goals of the program were to (1) design and construct a CFBC test facility, thereby providing a test facility at an independent laboratory, (2) demonstrate that the test unit is capable of meeting the original design objectives, and (3) assess the ability of the unit to provide scalable data.

6257 (CONF-9106303–, pp. 27-30) **Roles of additives and surface control in slurry atomization.** Tsai, S.C. (California State Univ., Long Beach (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract

FG22-88PC88912. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objectives are (1) to promote further understanding of the mechanisms and the roles of additives in airblast atomization of coal water slurry (CWS); (2) to investigate the impacts of coal particle surface properties and interparticle forces on CWS rheology. Micronized CWSs with flow behavior indices ranging from 0.7 (pseudoplastic) to 1.0 (Newtonian) have been prepared using anionic dispersant at concentrations ranging from 0.32 wt% to 1.35 wt% polymer (on a coal basis). The effect of particle size at similar size distributions on the relative viscosity of a pseudoplastic CWS can be approximated by particle Peclet number. The atomized CWS drop mass median diameters resulting from primary atomization follow the wave mechanism-based models. Nevertheless, much smaller drops (mass median diameter of 40 to 60 μm or SMD of 30 to 55 μm) than what these models predict have been obtained for CWS with 0.55 volume fraction of 18 m coal at air-to-slurry mass ratios of 0.175-0.30 and may be attributed to secondary atomization (breakup of primary drops).

6258 (CONF-9106303–, pp. 106-108) **Effects of calcium magnesium acetate on the combustion of coal-water slurries.** Levendis, Y.A. (Northeastern Univ., Boston, MA (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-89PC89776. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The general objective of the project is to investigate the combustion behavior of single Coal-Water Fuel (CWF) drops burning at high temperature environments. Combustion rates of both uncatalyzed as well as catalyzed CWS drops with Calcium Magnesium Acetate (CMA) catalyst will be obtained. Emphasis will also be given in assessing the effects of CMA on the sulfur capture during combustion. An experimental facility for high temperature combustion studies of liquid drops or solid fuel particles has been constructed and tested. The setup consists of a laminar flow, drop tube furnace capable of achieving maximum wall temperatures of 2,000 K, a three-color, near infrared optical pyrometer with associated calibration devices and a particle sampling probe. Furthermore, various droplet injector configurations were developed, and both a suction thermometer and a hot wire velocimeter were designed and constructed. Numerical techniques have been used to model the furnace environment, and optimize drop injection parameters and gas flow rates. Gas velocity and temperature profiles as well as particle water-evaporation times are also computed. Combustion data on CWF drops, obtained so far, clearly indicates heatup, devolatilization and char combustion periods.

6259 (CONF-9106303–, pp. 121-122) **Scale-up of circulating fluidized bed coal combustors.** Louge, M. (Cornell Univ., Ithaca, NY (United States)); Tanca, M. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-88PC88929. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

Circulating fluidization is a promising technology for designing efficient coal combustors with high solid throughputs. Unfortunately, limited understanding of circulating fluidized beds (CFB) renders design extrapolations of pilot reactors to full-scale plants both empirical and expensive. This project is aimed at quantifying the effects of scale-up upon the flow in CFB combustors and elucidating their hydrodynamics through models. For the experiments, the authors have constructed a cold CFB facility (diameter: 20cm; height: 7m) where gases are continuously recycled. In this way, the facility may be fluidized with mixtures of He and CO_2 with adjustable density and viscosity. Hydrodynamic analogy between the cold bed and a coal combustor is achieved by matching all relevant dimensionless parameters. Several choices of gas mixture composition and solid particle properties make the facility analogous to combustors of diameters in the range 30cm to 1m. Thus, direct quantification of scale-up is obtained in an ideal environment for detailed measurements. Principal accomplishments include: the construction of a CFB facility with recycled fluidization gases; the discovery of the importance of Coulomb friction in CFB dynamics; the completion of a series of tests that establish scaling rules for CFB combustors; and the development of models for hydrodynamics and heat transfer in pneumatic transport.

6260 (CONF-9106303–, pp. 132-133) **Predictive models for circulating fluidized bed combustors.** Gidaspow, D. (Illinois Inst. of Tech., Chicago (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-89PC89769. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The overall objective of this investigation is to develop experimentally verified hydrodynamic models for circulating fluidized bed (CFB) combustors. Flow regimes of dense phase vertical pneumatic transport of solids, referred to in the literature as circulating fluidized beds, have been computed using a generalization of the Navier-Stokes' equations for two fluids. In the less dense regime corresponding to volume fractions of solids of about one percent, the flow consists of centrally upward moving solids and downward moving clusters. In the dense regime, corresponding to volume fractions of about ten percent, a core-annulus type of regime is obtained with solids descending down at the wall. As an example of the capability of the authors' computer code, flows with and without reaction through a cross-section of a commercial circulating fluidized bed combustor were simulated. The volume fraction of solids in the riser part of the combustor was high near the inlet and then reached a fully-developed flow condition as expected. The system has large asymmetries, downflow of solids near some walls and operates in an oscillatory mode which promotes good heat and mass transfer. Aubrey L. Miller measured particle concentration profiles using an X-ray probe and flux profiles using an extraction probe for three sections of a CFB. Using these data and pressure drop information he computed particulate viscosities as a function of volume fraction of solids. The viscosities measured in the CFB are being compared to kinetic theory predictions which were obtained this year for the reasonbly dilute CFB regime. Preliminary results indicate that in order to obtain a match between the kinetic theory and the measurements, the restitution coefficient of particles must be very close to unity.

6261 (CONF-9106303–, pp. 137-138) **Combustion fume structure and dynamics.** Flagan, R.C. (California Inst. of Tech., Pasadena (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-90PC90286. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

This comprehensive study of the dynamics of pyrogenous fumes is designed to develop and validate a model of the formation and evolution of fine particles from minerals volatilized during coal combustion. Of particular interest is the structure that results when particles do not coalesce immediately upon agglomeration, the influence of sintering kinetics on that structure, and the influence of that structure on agglomeration kinetics. Focussing on the fundamental physics that govern the particle structure, size, and composition of fume particles formed in coal combustion, the experimental program is based upon model systems that have been designed to minimize the experimental uncertainties. Results to date of simulations and experimental are described.

6262 (CONF-9106303–, pp. 169-170) **Pyrite thermochemistry, ash agglomeration, and char fragmentation during**

pulverized coal combustion. Niksa, S. (Stanford Univ., CA (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-87PC79909. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

During p.f. firing of coal, the evolution of particulate ash from extraneous mineral matter is determined by thermochemistry, agglomeration of molten inclusions as the char is consumed, and fragmentation of the char into finer particulates. The transformation of pyrite inclusions into iron oxide ash is the primary focus of this program, including pyrite thermochemistry, the average number of ash particles per char particle, and the relation between the size distributions and compositions of mineral inclusions and ash particles. The proposed research utilizes synthetic chars with monodisperse pyrite inclusions and a range of controlled pore structures, including the mesosphere structures common to p.f. firing. Studies with the synthetic char establish an essential reference condition for analyzing the behavior of coal char. The size distributions and compositions of ash particulates from both the synthetic chars and coal chars will be monitored during simulated p.f. firing in the new radiant coal flow reactor. Mass concentrations of FeO, Fe_3O_4, $Fe_{1-x}S$, FeS_2, and Fe_2O_3 have been assigned from calibration curves developed with an intrinsic standard, to a relative uncertainty of 5%. Pyrolysis experiments with pyrite particles for furnace temperatures from 1,100K to 1,500K and the transient evolution of the iron ash constituents at 1,560K have been conducted. Experiments of iron ash oxidation have also been demonstrated. The observed compositions have been compared to thermochemical equilibrium compositions assigned in house.

6263 (CONF-9106303–, pp. 171-172) **Thermally induced structural changes in coal combustion.** Gavalas, G.R. (California Inst. of Tech., Pasadena (United States)); Flagan, R.C. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-88PC88911. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objective is to measure thermally induced structural changes occurring at temperatures and times typical of pulverized combustion and determine the changes in the intrinsic combustion rate caused by these structural changes. Experimental methods and materials are described. An important trend of declining reactivity with conversion during char combustion was established. It was also found that chars produced by devolatilization at temperatures below 1,400K undergo significant shrinking upon oxidation, even at temperatures at which pore diffusion is not limiting.

6264 (CONF-9106303–, pp. 177-178) **Effects of catalytic mineral matter on CO/CO_2 ratio, temperature and burning time for char combustion.** Longwell, J.P. (Massachusetts Inst. of Tech., Cambridge (United States)); Sarofim, A.F. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-89PC89774. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objective of this program is to determine the CO/CO_2 ratio generated at or near the surface of burning char as a function of temperature gas composition and char properties with a special emphasis on the effect of catalytic mineral constituents. The electrodynamic balance, developed in the authors' laboratory is being used to study the oxidation of 200μm spherocarb char particles. The weight, oxidation rate, and surface area of individual char particles are measured. CO/CO_2 ratio produced by oxidation was determined by gas chromatography. CO/CO_2 ratio for uncatalyzed spherocarb was measured over a temperature range of 750-1,400 K for steady-state conditions where little oxidation took place in the surrounding cold gas. Above this temperature significant oxidation of CO to CO_2 took place in the gas phase. The CO/CO_2 ratio increases from 0.1 to 700 K to approximately 1.0 at 1,400 K for a 20% oxygen atmosphere. Increasing oxygen decreased the CO/CO_2 ratio. A model of char oxidation has been developed which takes into account the distribution of oxygen chemisorption energies on the char surface and which assumes that CO and CO_2 are formed on different chemisorption sites. Catalysis by calcium was found to increase the number of CO_2 sites with little effect on the CO producing sites. So far, the model results are quite consistent with the measurements.

6265 (CONF-9106303–, pp. 179-180) **Mineral transformations and fragmentation in coal combustion.** Edwards, B.F. (West Virginia Univ., Morgantown (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-89PC89791. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The author has studied fragmentation of pure char using a rate equation modeling approach. This fragmentation arises from oxidation in the char macropores leading to widening and fusion of pores, and finally to loss of integrity and to fragmentation as final bridges between different regions of a particle are consumed. The rate equation gives the particle mass distribution n(x,t) (the number of particles of mass x at time t) based on a fragmentation rate a(x), a reaction (mass loss) rate c(x), and a distribution $\bar{b}(x|y)$ of 'daughter' particle masses x produced by fragmentation of a parent particle of mass y. He has obtained analytical and numerical solutions to a rate equation for pure char fragmentation which illuminate various regimes of behavior. He has also calculated the kernels relevant to percolation clusters as a first step toward comparison with experiments. These results deepen the understanding of fragmentation needed to extend the models to include mineral matter.

6266 (CONF-9106303–, pp. 183-184) **Combustion of dense streams of coal particles.** Annamalai, K. (Texas A and M Univ., College Station (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-90PC90310. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objectives are to develop a group combustion approach in modeling transient combustion for both the cylindrical and spherical clouds of high volatile coal particles, and to use video-imaging of flame, obtain experimental data on combustion intensity and compare the experimental data with the predictions. The cloud model results have been generalized for planar, cylindrical and spherical clouds since the small scale experiments may involve a batch of particles (approximately spherical), cylindrical stream of particles through a circular slot and planar stream through a rectangular slit. Cylindrical cloud results have already been obtained for ignition time.

6267 (DOE/MC/22012–3003) **Refractory experience in circulating fluidized bed combustors, Task 7: Final report.** Vincent, R.Q. Fluidized-Bed Technologies, Inc., Chattanooga, TN (United States). Nov 1989. 177p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC21-85MC22012. Order Number DE91002083. Source: OSTI; NTIS; GPO Dep.

This report describes the results of an investigation into the status of the design and selection of refractory materials for coal-fueled circulating fluidized-bed combustors. The survey concentrated on operating units in the United States manufactured by six different boiler vendors: Babcock and Wilcox, Combustion Engineering, Foster Wheeler, Keeler Dorr-Oliver, Pyropower, and Riley Stoker. Information was obtained from the boiler vendors, refractory suppliers and installers, and the owners/operators of over forty units. This work is in support of DOE's Clean Coal Technology program, which includes circulating fluidized-bed technology as one of the selected concepts being evaluated.

6268 (DOE/MC/25137–2999) **Nucla CFB Demonstration Project: Detailed public design report.** Colorado-Ute Electric Association, Inc., Montrose, CO (United States). Dec 1990. 253p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FC21-89MC25137. Order Number DE91002081. Source: OSTI; NTIS; GPO Dep.

This report documents Colorado-Ute Electric Association's Nucla Circulating Atmospheric Fluidized-Bed Combustion (AFBC) demonstration project. It describes the plant equipment and system design for the first US utility-size circulating AFBC boiler and its support systems. Included are equipment and system descriptions, design/background information and appendices with an equipment list and selected information plus process flow and instrumentation drawings. The purpose of this report is to share the information gathered during the Nucla circulating AFBC demonstration project and present it so that the general public can evaluate the technical feasibility and cost effectiveness of replacing pulverized or stoker-fired boiler units with circulating fluidized-bed boiler units. (VC)

6269 (DOE/PC/79651–T2) **Advanced coal-fired glass melting development program: Phase 2, Final report.** Vortec Corp., Collegeville, PA (United States). May 1991. 136p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-87PC79651. Order Number DE92000456. Source: OSTI; NTIS; GPO Dep.

The objective of Phase 1 of the current contract was to verify the technical feasibility and economic benefits of Vortec's advanced combustion/melting technology using coal as the fuel of choice. The objective of the Phase 2 effort was to improve the performance of the primary components and demonstrate the effective operation of a subscale process heater system integrated with a glass separator/reservoir. (VC)

6270 (DOE/PC/79850–6) **Nitrogen oxide abatement by distributed fuel addition: Quarterly report No. 6, November 1, 1988–January 31, 1989.** Wendt, J.O.L.; Mereb, J.B. Arizona Univ., Tucson, AZ (United States). Dept. of Chemical Engineering. 28 Feb 1989. 47p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-87PC79850. Order Number DE92005208. Source: OSTI; NTIS; GPO Dep.

A screening study was performed on a laboratory scale down-fired combustor to determine the effect of various variables on the effectiveness of the reburning process as a technique for NO_X abatement. The objective was to define optimum conditions under which reburning can be used and to be able to compare the reburning performance of our combustor to those reported by others. For this purpose, a statistically designed parametric investigation was conducted to determine how a set of controlled variables (primary and secondary stoichiometric ratios, location and length of the reburn zone and primary fuel load) would affect the reduction in NO emissions due to reburning. Also, the effects of other variables (NO in the primary zone, temperatures in the primary, reburn and burnout zones and the residence time in the reburn zone) were also investigated.

6271 (DOE/PC/79850–7) **Nitrogen oxide abatement by distributed fuel addition: Quarterly report No. 7, February 1, 1989–April 30, 1989.** Wendt, J.O.L.; Mereb, J.B. Arizona Univ., Tucson, AZ (United States). Dept. of Chemical Engineering. 20 Jun 1989. 7p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-87PC79850. Order Number DE92005209. Source: OSTI; NTIS; GPO Dep.

A combustor has been designed in order to retard the formation of nitrogen oxides by injection of reburning fuel. The design and the rebuilding of the new combustor was completed. Several new features were incorporated in the new design so that it would last longer. The design and construction of the furnace are discussed in this report. (VC)

6272 (DOE/PC/79850–8) **Nitrogen oxide abatement by distributed fuel addition: Quarterly report No. 8, May 1, 1989–July 31, 1989.** Wendt, J.O.L.; Mereb, J.B. Arizona Univ., Tucson, AZ (United States). Dept. of Chemical Engineering. 25 Aug 1989. 19p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-87PC79850. Order Number DE92005210. Source: OSTI; NTIS; GPO Dep.

The performance of the new combustor was tested. Experiments showed that this combustor has superior insulating quality than the previous one. Measured radial concentrations indicated uniform distribution of the primary fuel (coal) inside the fire tube resulting in reasonably flat concentration profiles. However, measured radial concentrations after the addition of the reburn fuel showed uneven distribution of the fuel resulting in parabolic concentration profiles, an indication of insufficient mixing in the reburn zone. In order to study mechanisms of nitrogenous species destruction in the reburn zone, it is necessary to achieve adequate mixing if the assumption of one dimensional plug flow behavior is to be valid. Thus, it became necessary to modify the injector design and the injection mode of the reburn fuel to achieve an adequate level of mixing which is the focus of this report. The results show that a minimum reburn fuel jet velocity of 15 m/s (standard conditions) was required which is about 80 times the velocity of the primary effluent. The use of nitrogen gas as a transport medium for the reburn fuel was necessary to achieve the desired jet velocities.

6273 (DOE/PC/79850–9) **Nitrogen oxide abatement by distributed fuel addition: Quarterly report No. 9, August 1, 1989–October 31, 1989.** Wendt, J.O.L.; Mereb, J.B. Arizona Univ., Tucson, AZ (United States). Dept. of Chemical Engineering. 20 Nov 1989. 35p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-87PC79850. Order Number DE92005211. Source: OSTI; NTIS; GPO Dep.

Experiments were conducted to investigate the processes that influence the destruction of NO in the fuel rich stage of the reburning process. The objective is to gain a better understanding of the mechanisms that control the fate of coal nitrogen in the fuel rich zone of a combustion process. Time resolved profiles of temperature, major (CO_2, CO, H_2O, O_2, H_2 and N_2), nitrogenous (NO, HCN and NH_3) and hydrocarbon (CH_4 and C_2H_2) species were obtained for various reburning tests. A slow continuous source of HCN was observed in the reburn zone for most tests. HCN formation from NO + CH_i reactions would partially explain this trend. It has been proposed in the past that these reactions would be fast (less than 0.1s) and the produced HCN would be short lived. However, evidence was provided in this study indicating that NO + CH_i reactions might contribute to HCN formation at longer residence times in the reburn zone. Reactions of molecular nitrogen with hydrocarbon radicals were determined to be a significant source of HCN formation, especially as NO levels decreased in the reburn zone. The results of several tests would justify the exclusion of continued coal devolatilization in the reburn zone as a major source of HCN.

6274 (DOE/PC/79850–10) **Nitrogen oxide abatement by distributed fuel addition: Quarterly report No. 10, November 1, 1989–January 31, 1990.** Wendt, J.O.L.; Mereb, J.B. Arizona Univ., Tucson, AZ (United States). Dept. of Chemical Engineering. 1 Feb 1990. 23p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-87PC79850. Order Number DE92005212. Source: OSTI; NTIS; GPO Dep.

Mechanisms governing the inter-conversion and destruction of nitrogenous species in the fuel rich reburning zone of a laboratory coal combustor were explored. Emphasis was on a configuration in which the primary flame was of pulverized coal and the reburning fuel was natural gas, although other fuels were also considered. The objective was to extract models to be used in estimating reburning effectiveness in practical combustors. Reburning mechanisms occur in two regimes; one in which fast reactions between NO and hydrocarbons are usually limited by mixing; the other in which reactions have slowed and in which known gas phase chemistry controls. For the latter regime, a simplified model based on detailed gas phase chemical kinetic mechanisms and known rate coefficients was able to predict temporal profiles of NO, NH_3 and HCN. Reactions with hydrocarbons played important roles in both regimes and the Fenimore N_2 fixation reactions limited reburning effectiveness at low primary NO values.

6275 (DOE/PC/88654–T3) **Combustion characterization of beneficiated coal-based fuels: Quarterly report No. 4,**

February–April 1990. Chow, O.K.; Nsakala, N.Y. Combustion Engineering, Inc., Windsor, CT (United States). Jun 1990. 47p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-89PC88654. Order Number DE92004870. Source: OSTI; NTIS; GPO Dep.

The objectives of this project include: (1) the development of an engineering data base which will provide detailed information on the properties of BCFs influencing combustion, ash deposition, ash erosion, particulate collection, and missions; and (2) the application of this technical data base to predict the performance and economic impacts of firing the BCFs in various commercial boiler designs. The technical approach used to develop the technical data includes: bench-scale fuel property, combustion, and ash deposition tests; pilot-scale combustion and ash effects test; and full-scale combustion tests.

6276 (DOE/PC/88697–T4) **Superclean coal-water slurry combustion testing in an oil-fired boiler: Semiannual technical progress report, February 15, 1991–August 15, 1991.** Miller, B.G.; Morrison, J.L.; Xie, Jiangyang; Walsh, P.M.; Schobert, H.H.; Scaroni, A.W. Pennsylvania State Univ., University Park, PA (United States). Combustion Lab. 1 Oct 1991. 48p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FC22-89PC88697. Order Number DE92004583. Source: OSTI; NTIS; GPO Dep.

Pennsylvania State University is conducting a superclean coal-water slurry (SCCWS) program with the objective of determining the capability of effectively firing SCCWS in an industrial boiler designed for oil. Penn State has entered into a cooperative agreement with DOE to determine if SCCWS (a fuel containing coal with less that 3.0% ash and 0.9% sulfur) can effectively be burned in an oil-designed industrial boiler without adverse impact on boiler rating maintainability, reliability, and availability. The project will provide information on the design of new systems specifically configured to fire these clean coal-based fuels.

6277 (DOE/PC/89651–T2) **Innovative clean coal technology (ICCT): 500 MW demonstration of advanced wall-fired combustion techniques for the reduction of nitrogen oxide (NO_x) emissions from coal-fired boilers: Phase 1, Baseline tests report.** Southern Co. Services, Inc., Birmingham, AL (United States); Energy Technology Consultants, Irvine, CA (United States). 13 Sep 1991. 193p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FC22-90PC89651. Order Number DE92002133. Source: OSTI; NTIS; GPO Dep.

The major objectives of the project are to: (1) demonstrate the performance of three combustion NO_x control technologies; (2) determine the short-term NO_x emission trends for each of the operating configurations; (3) determine the dynamic long-term NO_x emission characteristics for each of the operating configurations using sophisticated statistical techniques; (4) evaluate progressive cost-effectiveness (i.e., dollars per ton of NO_x removed) of the low NO_x combustion technologies tested; and (5) determine the effects on other combustion parameters (e.g., CO production, carbon carry-over, particulate characteristics) of applying the low NO_x combustion technologies. (VC)

6278 (DOE/PC/89659–2) **Mathematical and experimental pilot-scale study of coal reburning for NO_x control in cyclone boilers.** Farzan, H.; Wessel, R.A. Babcock and Wilcox Co., Alliance, OH (United States). Research and Development Div. Jun 1991. 123p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FC22-90PC89659. Order Number DE92000029. Source: OSTI; NTIS; GPO Dep.

The purpose of this pilot-scale study was to examine the effectiveness of reburning for NO_x reduction and to assess the potential side effects. In addition, the potential of a high-sulfur Illinois coal for cyclone reburning application was evaluated. (VC)

6279 (DOE/PC/89776–T5) **Effects of calcium magnesium acetate on the combustion of coal-water slurries: Project status report, 1 September 1989–30 November 1989.** Northeastern Univ., Boston, MA (United States). Dept. of Chemical Engineering. [1989]. 16p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-89PC89776. Order Number DE92004499. Source: OSTI; NTIS; GPO Dep.

The general objectives of the project is to investigate the combustion behavior of single Coal-Winter Slurry particles burning at high temperature environments. Both uncatalyzed as well as catalyzed CWS drops with Calcium Magnesium Acetate (CMA) catalyst will be investigated. Emphasis will also be given in the effects of CMA on the sulfur capture during combustion.

6280 (DOE/PC/90176–T54) **Cyclone reburning retrofit-corrosion evaluation: Final technical report, September 1, 1990–August 31, 1991.** Sarv, H. Babcock and Wilcox Co., Alliance, OH (United States). [1991]. 25p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-90PC90176. Order Number DE92004190. Source: OSTI; NTIS; GPO Dep.

Reduction of oxides of nitrogen (NO_x) from cyclone-equipped boilers is best accomplished by the application of reburning technology. Reburning process involves injection of a supplementary fuel above the cyclone to create a reducing zone for NO_x removal. Overfire air is introduced above this zone to achieve complete combustion. Since the reburning zone must operate substoichiometrically, tube corrosion due to H_2S formation within the modified combustion zones can be a potential concern when the reburning fuel is a high-sulfur coal. H_2S is a corrosive gas and its concentration is an indicator of the tendency for fireside corrosion in fuel-rich combustion systems. This research program was undertaken to assess corrosion resistance of three commercially available alloys (carbon steel, SA210-A1; low-alloy steel, SA213-T22; and stainless steel, SA213-TP304) as well as coated steel alloy (SA213-T2). The surface chromium contents of the alloys ranged from 0 to 30%. Four air-cooled corrosion probes, each containing segments of the selected alloys were constructed. The probes were exposed for up to 1200 hours and at a metal temperature of 850°F to combustion gases generated by firing a high-sulfur Illinois #6 coal at conditions simulating coal reburning.

6281 (DOE/PC/90275–T18) **Development of an advanced high efficiency coal combustor for boiler retrofit: Task 3, Demonstration scale testing at 50×10^6 BTU/HR: Final report.** LaFlesh, R.C.; Rini, M.J.; McGowan, J.G. Combustion Engineering, Inc., Windsor, CT (United States). Apr 1989. 86p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-86PC90275. Order Number DE92004972. Source: OSTI; NTIS; GPO Dep.

The objective of this program is to develop an advanced coal-combustion system capable of being retrofitted to industrial boilers originally designed for firing natural gas, distillate, and/or residual oil. Through the use of beneficiated coal fuel and advanced combustion technology, the program was to produce a combustion system which is reliable, simple to operate, and incorporates significant reductions in NO_x, SO_x, and particulate emissions over a base coal case. (VC)

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Refer also to citation(s) 6107, 6805, 6821

6282 (ANL/CP–72016) **Clean coal technology and emissions trading: Is there a future for high-sulfur coal under the Clean Air Act Amendments of 1990?.** Bailey, K.A. (Argonne National Lab., IL (United States)); South, D.W.; McDermott, K.A. Argonne National Lab., IL (United States). [1991]. 25p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-31109-ENG-38. (CONF-910819–2: 4. international conference on processing and utilization of high sulfur coals, Idaho Falls, ID (United States), 26-30 Aug 1991). Order Number DE92004717. Source: OSTI; NTIS; GPO Dep.

The near-term and long-term fate of high-sulfur coal is linked to utility compliance plans, the evolution of emission allowance trading, state and federal regulation, and technological innovation. All of these factors will play an implicit role in the demand for high-sulfur coal. This paper will explore the potential impact that emissions trading will have on high-sulfur coal utilization by electric utilities. 28 refs., 6 figs., 4 tabs.

6283 (ANL/CP–74713) **Tradeable CO_2 emission permits for cost-effective control of global warming.** Kosobud, R.F.; South, D.W.; Daly, T.A.; Quinn, K.G. Argonne National Lab., IL (United States). [1991]. 14p. Sponsored by U.S. DOE Fossil Energy. DOE

Contract W-31109-ENG-38. (CONF-911184-6: 13. annual North American conference of the International Association for Energy Economics, Chicago, IL (United States), 18-20 Nov 1991). Order Number DE92003519. Source: OSTI; NTIS; INIS; GPO Dep.

Many current global warming mitigation policy proposals call for large, near-term reductions in CO_2 emissions, thereby entailing high initial carbon emission tax rates or permit prices. This paper claims that these high initial tax rates or permit prices are not cost-effective in achieving the desired degree of climate change control. A cost-effective permit system is proposed and described that, under certain assumptions, would allow markets to optimally lead permit prices along a gradually increasing trajectory over tie. This price path presents the Hotelling result and would ease the abrupt, inefficient, and costly adjustments imposed on the fossil fuel and other industries in current proposals. This finding is demonstrated using the Argonne Model, a linear programming energy-environmental-economic model that allows for intertemporal optimization of consumer energy well-being. 12 refs., 3 figs., 1 tab.

6284 (ANL/EAIS/TM-62) **Clean coal technologies—An International seminar: Seminar evaluation and identification of potential CCT markets.** Guziel, K.A.; Poch, L.A.; Gillette, J.L.; Buehring, W.A. Argonne National Lab., IL (United States). Environmental Assessment and Information Sciences Div. Jul 1991. 37p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-31109-ENG-38. Order Number DE92004778. Source: OSTI; NTIS; INIS; GPO Dep.

The need for environmentally responsible electricity generation is a worldwide concern. Because coal is available throughout the world at a reasonable cost, current research is focusing on technologies that use coal with minimal environmental effects. The United States government is supporting research on clean coal technologies (CCTs) to be used for new capacity additions and for retrofits to existing capacity. To promote the worldwide adoption of US CCTs, the US Department of Energy, the US Agency for International Development, and the US Trade and Development Program sponsored a two-week seminar titled Clean Coal Technologies – An International Seminar. Nineteen participants from seven countries were invited to this seminar, which was held at Argonne National Laboratory in June 1991. During the seminar, 11 US CCT vendors made presentations on their state-of-the-art and commercially available technologies. The presentations included technical, environmental, operational, and economic characteristics of CCTs. Information on financing and evaluating CCTs also was presented, and participants visited two CCT operating sites. The closing evaluation indicated that the seminar was a worthwhile experience for all participants and that it should be repeated. The participants said CCT could play a role in their existing and future electric capacity, but they agreed that more CCT demonstration projects were needed to confirm the reliability and performance of the technologies.

6285 (CONF-910571–, pp. 84-93) **The economic case for industrial application of low-rank coal technology.** Irwin, W. (International Coal Preparation Consultants Ltd., Calgary, Alberta (Canada)). North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. [1991]. From 16. biennial low-rank fuels symposium; Billings, MT (United States); 20-23 May 1991. In *Proceedings of the sixteenth biennial low-rank fuels symposium.* 535p. Order Number DE92002606. Source: OSTI; NTIS; INIS.

The World Coal Institute estimates coal should overtake oil as the world's largest source of primary energy by the turn of the century. Current world coal production of 3.6 billion tons in 1990 is predicted to rise to 4 billion tons by the year 2000. It is conceded that a major environmental problem with burning coal is the so-called greenhouse effect. The question is how do you use the new technologies that have been developed which now allow coal to be burned with minimum damage to the environment. Despite their technical merits, acceptance of these new technologies is slow because they appear uncompetitive when compared with historic energy costs. Unless economic comparisons include some form of environmental evaluation, this issue will continue to be a barrier to progress. To avoid stagnation and provide the necessary incentive for implementing badly needed change, structural changes in energy economics need to be made which take into account the environmental cost element of these emerging new technologies. The paper discusses coal trade and quality and then describes the three main areas of development of clean coal technologies: coal preparation, combustion, and flue gas treatment.

6286 (DOE/EIA-0121(91/2Q)) **Quarterly coal report, April–June 1991.** USDOE Energy Information Administration, Washington, DC (United States). Office of Coal, Nuclear, Electric and Alternate Fuels. 19 Nov 1991. 148p. Sponsored by U.S. DOE Energy Information Administration. Order Number DE92003716. Source: OSTI; NTIS; GPO; GPO Dep.

The Quarterly Coal Report provides comprehensive information about US coal production, exports, imports, receipts, consumption, and stocks to a wide audience, including Congress, Federal and State agencies, the coal industry, and the general public. The data represented in this report are collected and published by the Energy Information Administration (EIA) to fulfill data collection and dissemination responsibilities as specified in the Federal Energy Administration Act of 1974 (Public Law 93-275) as amended. This issue presents detailed quarterly data for April 1991 through June 1991, aggregated quarterly historical data for 1983 through the fourth quarter of 1990, and aggregated annual historical data for 1960 through 1990 and projected data for selected years from 1991 through 2010. Appendix C displays, from 1980 on, detailed quarterly historical coal imports data, as specified in Section 202 of the Energy Policy and Conservation Amendments Act of 1985 (Public Law 99-58). Appendix D gives selected quarterly tables converted to metric tons. To provide a complete picture of coal supply and demand in the United States, historical information and forecasts have been integrated in this report. Additional historical data can also be found in the following EIA publications: Annual Energy Review 1990 (DOE/EIA-0384(90)), Monthly Energy Review (DOE/EIA-0035), and Coal Data: A Reference (DOE/EIA-0064(90)). Other projections can be found in the Short-Term Energy Outlook (DOE/EIA-0202), a quarterly report, and in the Annual Energy Outlook 1991 (DOE/EIA-0383(91)). 7 figs., 37 tabs.

6287 (DOE/EIA-M-048) **Coal supply and transportation model (CSTM): Model documentation.** USDOE Energy Information Administration, Washington, DC (United States). Office of Integrated Analysis and Forecasting. Nov 1991. 160p. Sponsored by U.S. DOE Energy Information Administration. Order Number DE92003555. Source: OSTI; NTIS; INIS; GPO; GPO Dep.

The Coal Supply and Transportation Model (CSTM) forecasts annual coal supply and distribution to domestic and foreign markets. The model describes US coal production, national and international coal transportation industries. The objective of this work is to provide a technical description of the current version of the model.

6288 (ETDE-mf-2750311) **Black coal. Facts and trends 1991.** Gesamtverband des Deutschen Steinkohlenbergbaus, Essen (Germany). 1991 84p. (In German). Order Number DE92750311. Source: OSTI; NTIS (US Sales Only).

Pictures illustrate the major development on the energy sector, especially in coal mining, and the characteristic figures and data. (HS).

6289 (ORNL/TM-11787) **Marketable permits for controlling sulphur dioxide emissions.** Hale, D.R. (USDOE Energy Information Administration, Washington, DC (United States)); Bjornstad, D.J. Oak Ridge National Lab., TN (United States). Dec 1991. 16p. Sponsored by U.S. DOE Energy Information Administration. DOE Contract AC05-84OR21400. Order Number DE92003947. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this paper is to describe research sponsored by the Energy Information Administration (EIA) at the Oak Ridge National Laboratory (ORNL) into the nature of the auctions described in the bills. The research was undertaken at the request of the House Committee on Energy and Commerce to assess how various provisions in the bills might affect the workings of the market. Because the project called for the analysis of market mechanisms that do not now exist, a "laboratory" approach was applied in which artificial markets are created using computerized trading, volunteer subjects, and cash incentives to mimic the markets being studied.

Dr. Mark Isaac, at the University of Arizona, and Dr. Jamie Kruse, at the University of Colorado, led teams that designed and conducted the laboratory experiments. 4 figs., 5 tabs.

0160 Health and Safety

Refer also to citation(s) 6250, 6251

6290 (ETDE/JP-mf–2749181) **Handbook of safety technology of coal mines. 3.: Spontaneous combustion.** Mining and Material Processing Inst. of Japan, Tokyo (Japan). Mar 1991 80p. (In Japanese). Order Number DE92749181. Source: OSTI; NTIS (US Sales Only).

Of safety technologies of coal mines summarized as a handbook, described is the safety technology on spontaneous combustion. The spontaneous combustion of coal is caused by storage of oxidation heat, but real factors causing the combustion are complicated. Immediate detection by a centralized monitoring sensor of generated gases (CO, CH_4, air leakage), temperatures and odors are contributed to reduction of accidents. The spontaneous combustion is apt to occur in mine roadway and abandoned shafts and by disturbance and degradation of the remaining coal left alone and by air leakage. It is important to shield a ventilation current and secure sealing after mining. The fly ash (FA) method in which FA slurry is streamed and transported for filling-up brought an ennovation to measures against spontaneous combustion. As a direct fire-fighting method, the following interception of fire source is cited: watering pipes, boring water-pouring, milk state liquid injection, foam-plug, FA-plug. As an indirect fire-fighting method, the following are cited: a method in which the mine roadway is lined and the inside of the lining is filled with FA, etc. for sealing, a sealing dam construction method. Some accidents at coal mines and prevention measures are also explained. 49 refs., 45 figs., 23 tabs.

6291 (ETDE/JP-mf–2749182) **Handbook of safety technology of coal mimes. 4.: Mine fires.** Mining and Material Processing Inst. of Japan, Tokyo (Japan). Mar 1991 67p. (In Japanese). Order Number DE92749182. Source: OSTI; NTIS (US Sales Only).

Of safety technologies of coal mines summarized as a handbook, described is the safety technology on mine fires. The mine fire is a phenomenon that combustible materials burn and the fire spreads along the mine roadway or the working face. Heat, smoke and gas affect each other and their interaction is complicated. Danger of fire spread in a large range is predicted because in the mine there are combustible materials which are installed in sequence as timbers, conveyor belts, cables and a large amount of ventilation is conducted. Also, there are hot air flow and gas including a lot of harmful ingradients on the leeward of the mine, and the high possibility of a serious accident is predicted. The colsed space which stores heat and is filled with gas makes escape and fire-fighting difficult. Advanced auto fire detecting systems have recently appeared. As well as prevention of the fire, prevention of the fire spread is important, and therefore measures against the fire spread are taken such as making the inside of mine roads non-combustible and fire-retardant, making fire-resistant and fire-preventable mine roadways, making water spray zones. In addition to chemicals, sand, rock dust and water for extinguishing fires, foam is introduced to the fire-fighting technology. Use of liquid nitrogen and inert gas is also under study. Some accidents and analysis of the causes are described. 109 refs., 52 figs., 15 tabs.

0170 Legislation and Regulations

Refer also to citation(s) 6289

02 PETROLEUM

0202 Reserves, Geology, and Exploration

Refer also to citation(s) 7817

6292 (DOE/EIA–0370(91)) **Oil and gas field code masterlist 1991.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 23 Dec 1991. 426p. Sponsored by U.S. DOE Energy Information Administration. Order Number DE92004898. Source: OSTI; NTIS; INIS; GPO; GPO Dep.

The Oil and Gas Field Code Master List 1991 is the tenth annual listing of all identified oil and gas fields in the United Sates. It is updated with field information collected through October 1991. The purpose of this publication is to provide codes for easy identification of domestic fields. Standardization on these field codes will foster consistency of field identification by government and industry.

6293 (IFP–37-606) **Two-dimensional model of transport phenomena in sedimentary basins by finite element method.** Bouvier, V. Institut Francais du Petrole (IFP), 92 - Rueil-Malmaison (France); Ecole Nationale Superieure des Mines, 75 - Paris (France). 1989. 329p. (In French). Order Number DE92733713. Source: OSTI; NTIS (US Sales Only).

A finite element method is applied to a two-dimensional numerical model of transport phenomena occurring in the sedimentary basins during their formation. The physics used -conservation laws, Darcy's law, compaction laws for porous media, evolution laws for thermal and hydrodynamical coefficients- is that which is used in the THEMIS model, already developed at the French Petroleum Institute. The flow problem is written in variational form, whose main unknown is the fluid pressure. The most important difficulties encountered are relative to the domain evolution (compaction, sedimentation, erosion) and highly permeable sediments such as sands. The complexity of the medium deformation is numerically described by a moving mesh whose movement is linked to that of the solid material and which is composed of quadrangles and triangles. Thermal phenomena are also modeled. The same approach as that used for the resolution of the fluid problem is applied to solve the heat equation. Many tests and comparisons with finite volume method were performed. They showed a good numerical and physical behaviour of the finite element method. This method is better adapted than the other one for modeling heterogeneous and geometrically complicated geological media. The study of a North Sea geological cross-section showed the model's capability in simulating the physical phenomena of flow in a complex environment.

6294 (Juel–2496) **Quantitative and qualitative analysis of fossil hydrocarbons and their conversion products in Posidonia shale soils (Ith-Hils trough).** Schramedei, R. Forschungszentrum Juelich GmbH (Germany). Inst. fuer Chemie 5 - Erdoel und Organische Geochemie; Koeln Univ. (Germany). Jul 1991. 159p. (In German). Order Number DE92750124. Source: OSTI; NTIS (US Sales Only).

Samples of unaltered Posidenra skale out of shallow wells were compared with samples of weathered persidonia stale from soils in order to investigate the conversion of the organic material by weathering and the soil burden of geogenic hydrocarbons from carbonaceons rocks. (orig./EF).

6295 **Multifold vertical seismic profile acquisition method and technique for imaging the flank of a salt dome.** McClellan, B.D.; Adams, O.T.; Cox, V.D. To Conoco Inc. (USA). 23 Aug 1991. Filed date 23 Feb 1990. Canada Patent patent application 2010842. 22p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $4.00 CAN; MF $2.75 CAN.

A seismic layout and processing technique is disclosed for providing better data acquisition relative to salt domes. The technique utilizes a line of acoustic pulse sources in a selected pattern opposite a salt flank from a wellbore, and a plurality of spaced acoustic receivers are disposed along the wellbore. Normally, a near offset is used when the salt dome interface is shallow and a far offset when the interface is deep. Acoustic pulses are generated and a first break time is determined when the pulses first pass the receivers on their way to the interface. A total travel time is obtained when the pulses are reflected by the vertical interface and travel back to the receivers. A 2-way travel time is calculated from a pseudo seismic source location to the receivers by subtracting the first break time from the total travel time. The data are processed to establish a pseudo-source point along the wellbore in relation to each of the receiver points to enable subsequent common depth point processing of the data. In this manner, a vertical common reflection point outline of the vertical flank of the salt dome is established. The technique of the invention requires no initial geologic model for processing and, in fact, gives a first estimate of the geologic model required for the usual processing. The unique orientation of the resulting common midpoint gather, along with the high source/receiver multiplicity, results in a seismic image of the salt face that is superior to that obtainable from currently available vertical seismic profile technology. The technique is illustrated for the case of a marine exploration effort in order to emphasize its effectiveness. 4 figs.

0203 Drilling and Production

6296 (DOE/BC/14202–6) **Microbial enhancement of oil production from carbonate reservoirs: Final report, January 1990–May 1991.** Tanner, R.S.; Udegbunam, E.O.; McInerney, M.J.; Knapp, R.M.; Adkins, J.P. Oklahoma Univ., Norman, OK (United States). Nov 1991. 225p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-90BC14202. Order Number DE92001007. Source: OSTI; NTIS; GPO Dep.

The objective of this research contract was to examine MEOR in carbonate reservoirs by reviewing the literature pertinent to MEOR in carbonate systems, determining the microbial ecology of carbonate reservoirs, examining the effect of microorganisms on carbonate matrices, documenting MEOR in model carbonate core systems, and constructing a mathematical model for MEOR in carbonates. 11 refs., 19 figs., 38 tabs. (VC)

6297 (DOE/BC/14246–T10) **Microbial field pilot study: [Quarterly report], July 1, 1992–September 30, 1992.** Knapp, R.M.; McInerney, M.J.; Menzie, D.E. Oklahoma Univ., Norman, OK (United States). 6 Dec 1991. 8p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-89BC14246. Order Number DE92004433. Source: OSTI; NTIS; GPO Dep.

The objective of this project is to perform a microbial enhanced oil recovery field pilot test in the Southeast Vassar Vertz Sand Unit (SEVVSU) in Payne County, Oklahoma. Indigenous, anaerobic, nitrate-reducing bacteria will be stimulated to selectively plug flow paths which have been preferentially swept by a prior waterflood. This will force future flood water to invade bypassed regions of the reservoir and increase sweep efficiency. During this quarter an additional tracer study was performed in the field to determine pretreatment flow paths and the first nutrients were injected. 2 figs.

6298 (DOE/ER/13673–T2) **Fundamental studies of fluid mechanics and stability in porous media: Progress report.** Homsy, G.M. Stanford Univ., CA (United States). Dept. of Chemical Engineering. Aug 1991. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract FG03-87ER13673. Order Number DE92005268. Source: OSTI; NTIS; GPO Dep.

This report summarizes accomplished and proposed work for the fundamental studies of fluid mechanics and stability in porous media. Topics discussed include: viscous fingering in miscible displacements; polymer flow interactions in free shear layers of viscoelastic fluids; effect of nonmonotonic viscosity profiles on the stability of miscible displacements in porous media; and references. (JL)

6299 (IFP–37891) **Hydrocarbons production with horizontal and vertical wells: Analytic study of the steady state monophasic flows in presence or absence of a second phase.** Giger, F.M. Institut Francais du Petrole (IFP), 92 - Rueil-Malmaison (France); Ecole Nationale Superieure des Mines, 75 - Paris (France). Jul 1989. 160p. (In French). Order Number DE92733710. Source: OSTI; NTIS (US Sales Only).

The analytic study of the monophasic steady state flow towards a horizontal well gives the expression of its productivity and a description of the pressure field. A local criterion is derived out of it for the comparison of drainage efficiency between horizontal and vertical wells as well as a global criterion usable at the whole reservoir scale. The water cresting effect, induced by the hydrocarbons production with a horizontal well in presence of a second liquid phase is exactly described in two dimensions with an analytic solution. Permeability anisotropy and several feed mechanisms are coped with. In order to allow comparisons, a water coning model below a vertical well taking permeability anisotropy into account is established.

6300 (UCRL-JC–106751) **Redirection of dynamic compressive waves in materials with nearly orthogonal and random joint sets.** Walton, O.R.; Maddix, D.M.; Butkovich, T.R.; Heuze, F.E. Lawrence Livermore National Lab., CA (United States). Mar 1991. 11p. Sponsored by U.S. DOE Fossil Energy; U.S. Department of Defense. DOE Contract W-7405-ENG-48. (CONF-9106120–2: Recent advances on mechanics of structure continua American Society of Mechanical Engineers (ASME) applied mechanics conference, Columbus, OH (United States), 16-19 Jun 1991). Order Number DE92003700. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Two-dimensional discrete-particle (i.e., distinct-element) calculations demonstrate the redirection of particle velocity vectors emanating from a rapidly loaded region such as an explosively loaded borehole or tunnel. Previous simulations have demonstrated redirection of particle motions in randomly fractured media when significant shearing displacements result in dilatancy. This work shows redirection in media with nearly regular and nearly orthogonal joint sets, resulting in asymmetric radiation patterns, even for situations with quite small displacements. Random joint sets (simulated with Voronoi polygons) on the other hand, do not exhibit significant redirection of emanating signals unless significant shear displacements occur. Such redirection could account for anisotropic seismic radiation patterns observed around deeply buried explosions in hard rock. Variation of contact parameters and joint models in these simulations serves to demonstrate that the joint pattern and block kinematics are the dominant mechanisms contributing to this redirection of the compressive waves. 24 refs., 8 figs.

6301 **In-situ tuned microwave oil extraction process.** Kiamanesh, A.I. 12 Aug 1991. Filed date 12 Feb 1990. Canada Patent patent application 2009782. 26p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $4.00 CAN; MF $2.75 CAN.

A method is provided for extracting oil or enhancing oil extraction from underground reservoirs. The method devises and customizes an electromagnetic irradiation protocol to individual reservoirs. Reservoir samples are tested to determine their oil content, molecular resonance frequencies and the effects of the electromagnetic field on their compounds. Electromagnetic field frequency, intensity, and duration necessary to heat and/or crack individual molecules is determined. Equipment is selected and installed in underground excavations according to the results of the laboratory tests and the geophysics of the deposit. The dielectric constant of the formation is reduced by draining water and drying the formation with electromagnetic energy. A combination of the effects of microwave flooding, plasma torch activation, molecular cracking, and selective heating is used to heat the oil within the reservoir by controlling frequency, duration, intensity, direction, and waveform of the electromagnetic field. The reservoir conditions are continuously monitored during production to act as feedback for modification of the irradiation protocol. The invention is applicable to petroleum, oil sand, and oil shale deposits. 11 figs.

0204 Processing

Refer also to citation(s) 6108, 6145, 6166

0207 Economic, Industrial, and Business Aspects

Refer also to citation(s) 6807, 6808, 6809, 6810, 6812, 6813, 6814, 6815, 6816, 6817, 6819, 6820, 6821, 6822, 7517

6302 (DOE/EI/22627–T1) **No. 2 heating oil/propane program: Final report, 1990/91.** McBrien, J. Massachusetts Executive Office of Consumer Affairs and Business Regulation, Boston, MA (United States). Div. of Energy Resources. Jun 1991. 24p. Sponsored by U.S. DOE Energy Information Administration. DOE Contract FC01-91EI22627. Order Number DE92005261. Source: OSTI; NTIS; INIS; GPO Dep.

During the 1990/91 heating season, the Massachusetts Division of Energy Resources (DOER) participated in a joint data collection program between several state energy offices and the federal Department of Energy's (DOE) Energy Information Administration (EIA). The purpose of the program was to collect and monitor retail and wholesale heating oil and propane prices and inventories from October 1990 through March 1991. This final report begins with an overview of the unique events which had an impact on the reporting period. Next, the report summarizes the results from the residential heating oil and propane price surveys conducted by DOER over the 1990/91 heating season. The report also incorporates the wholesale heating oil and propane prices and inventories collected by the EIA and distributed to the states.

6303 (DOE/EIA–0538(91/92-7)) **Winter Fuels Report week ending: November 8, 1991.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 14 Nov 1991. 70p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. Order Number DE92003390. Source: OSTI; NTIS; INIS; GPO; GPO Dep.

The Winter Fuels Report is intended to provide concise, timely information to the industry, the press, policymakers, consumers, analysts, and State and local governments on the following topics: distillate fuel oil net production, imports and stocks for all Petroleum Administration for Defense Districts (PADD) and product supplied on a US level; propane net production, imports and stocks for PADD's 1, 2, and 3; natural gas supply and disposition and underground storage for the United States and consumption for all PADD's; residential and wholesale pricing data for propane and heating oil for those States participating in the joint Energy Information Administration (EIA)/State Heating Oil and Propane Program; crude oil and petroleum price comparisons for the United States and selected cities; and US total heating degree-days by city.

6304 (DOE/EIA–0538(91/92-13)) **Winter fuels report week ending: December 20, 1991.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 27 Dec 1991. 70p. Sponsored by U.S. DOE Energy Information Administration. Order Number DE92004205. Source: OSTI; NTIS; GPO; GPO Dep.

The Winter Fuels Report is intended to provide concise, timely information to the industry, the press, policymakers, consumers, analysts, and State and local governments on the following topics: distillate fuel oil net production, imports and stocks for all Petroleum Administration for Defense Districts (PADD) and product supplied on a US level; propane net productions, imports and stocks for PADD's I, II, and III; natural gas supply and disposition and underground storage for the United States and consumption for all PADD's; residential and wholesale pricing data for propane and heating oil for those States participating in the joint Energy Information Administration (EIA)/State Heating Oil and Propane Program; crude oil and petroleum price comparisons for the United States and selected cities; and US total heating degree-days by city.

6305 (DOE/EIA–0538(91/92-14)) **Winter fuels report, week ending January 3, 1992.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 9 Jan 1991. 70p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. Order Number DE92004841. Source: OSTI; NTIS; GPO; GPO Dep.

The Winter Fuels Report is intended to provide concise, timely information to the industry, the press, policymakers, consumers, analysts, and State and local government on the following topics: distillate fuel oil net production, imports and stocks for all Petroleum Administration for Defense Districts (PADD) and product supplied on a US level; propane net production, imports and stocks for PADD's 1, 2, 3; natural gas supply and disposition and underground storage for the United States and consumption for all PADD's; residential and wholesale pricing data for propane and heating oil for those State participating in the joint Energy Information Administration (EIA)/State Heating Oil and Propane Program; crude oil and petroleum price comparisons for the United States and selected cities; and US total heating degree-days by city.

0208 Waste Management

Refer also to citation(s) 6562

0209 Environmental Aspects

Refer also to citation(s) 6783, 7555

6306 (OCS/EIS/EA/MMS–91-0054-Vol.1) **Gulf of Mexico Sales 139 and 141: Central and western planning areas: Final environmental impact statement: Volume 1, Sections 1 through 4.C.** Minerals Management Service, New Orleans, LA (United States). Gulf of Mexico OCS Regional Office. Nov 1991. 329p. Sponsored by U.S. Department of the Interior. Source: OSTI; Minerals Management Service, Gulf of Mexico OCS Region, 1201 Elmwood Park Blvd., New Orleans, LA 70123-2394.

This environmental impact statement (EIS) addresses two proposed Federal actions, lease Sales 139 and 141, that will offer for lease Gulf of Mexico Outer Continental Shelf (OCS) areas that may contain economically recoverable oil and gas resources. The lease sales are proposed for 1992 and include lease blocks in the Central Gulf of Mexico Planning Area (CPA) and Western Gulf of Mexico Planning Area (WPA). Approximately 9700 blocks will be available for lease under the two proposed actions; only a small percentage is expected to be actually leased. On average, 432 blocks in the Central Gulf and 279 blocks in the Western Gulf have been leased in individual Gulf of Mexico OCS lease sales since 1984. Of the blocks that will be leased as a result of the two proposed actions, only a portion will be drilled and will likely result in subsequent production. The analytical methods used in this EIS have been formulated over a period of years and are based on the methodology outlined within the National Environmental Policy Act (NEPA). The first step of the analysis is the identification of significant environmental and socioeconomic resources through the scoping process. A range of impact levels is then defined for each of the significant resources to be analyzed. A range of energy resource estimates is derived from geologic and economic assumptions and a range of alternatives to the proposed action is established.

6307 (OCS/EIS/EA/MMS–91-0054-Vol.2) **Gulf of Mexico Sales 139 and 141: Central and western planning areas: Final Environmental Impact Statement: Volume 2, Sections 4.D through 9.** Minerals Management Service, New Orleans, LA (United States). Gulf of Mexico OCS Regional Office. Nov 1991. 564p. Sponsored by U.S. Department of the Interior. Source: OSTI; Minerals Management Service, Gulf of Mexico OCS Region, 1201 Elmwood Park Blvd., New Orleans, LA 70123-2394.

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6308 **Apparatus for recuperating oil spills from water.** Slezak, M.L. 12 Aug 1991. Filed date 12 Feb 1990. Canada Patent patent application 2009785. 7p. (In French). Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $4.00 CAN; MF $2.75 CAN.

An apparatus for collecting spilled oil from a water surface is fitted with wheels and floats which allow it to operate on a beach as well as in deep water. Aspiration devices floating on the water, which are fixed in front of the apparatus, suck up the water mixed with a certain portion of oil. The inlets to the aspiration devices have variable openings which automatically adjust to the thickness of the oil layer, thus minimizing the quantity of water taken in. The aspirated liquid is fed to a bottomless reservoir formed from a retractable skirt where the oil/water mixture is separated. The oil, rising to the surface, is then recovered in a second reservoir placed at the center of the first reservoir, whose upper rim is automatically maintained just under the upper level of the oil, permitting the oil to flow into the second reservoir from which it can be pumped to a floating reservoir or any other container. 3 figs.

0210 Legislation and Regulations

6309 (DOE/EIA–0550) **Average effective corporate income tax rates for petroleum operations, 1977–1989.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. 18 Nov 1991. 40p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. Order Number DE92003942. Source: OSTI; NTIS; GPO; GPO Dep.

This study analyzes changes in average effective corporate income tax rates for the petroleum and aggregate operations of a major group of energy companies from 1977 to 1989. Effective rates are presented on a worldwide basis, as well as for domestic versus foreign operations. The analysis focuses on effective rates for the petroleum line of business (including both oil and gas) and for segments within that line. The study is based on data reported by major energy companies to the Energy Information Administration, using its Financial Reporting System. 5 figs., 10 tabs.

0220 Transport, Handling, and Storage

6310 **Apparatus for hydrocleaning the exterior surfaces of pipelines and the like.** Chapman, G.R.; Reid, C.M.; Seale, J.B.; Andruik, D.R. To Cups, Inc. (USA). 31 Aug 1991. Filed date 28 Feb 1990. Canada Patent patent application 2011196. 54p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $4.00 CAN; MF $2.75 CAN.

Oil and gas transmission pipelines of large diameter are usually coated and then buried before being used for transport of fluid. As a result of coating failures over the years, many pipeline operators have initiated coating rehabilitation projects. Improvements are disclosed which relate to apparatus utilized for removing old coatings and miscellaneous contaminants from the pipeline exterior surface. According to the invention, a hydrocleaning apparatus for pipelines includes a frame capable of advancing lengthwise of the pipeline. Such a frame carries a plurality of liquid jetting modules which, in use, are disposed in an array around the pipeline surface to enable cleaning of the entire surface. The frame can be opened up to allow the apparatus to be fitted to or removed from a continuous pipeline. The frame arrangement and module mounting system are designed to provide good cleaning efficiency and proper orientation of the various modules in spite of pipeline irregularities including out-of-round conditions, uneven coating thicknesses, and wrinkles. A pivoting module mount helps to maintain cleaning efficiency in the case where thick coatings are being removed. The frame drive wheels are disposed forwardly of the modules to avoid contamination of the cleaned surfaces by deposits that may build up on the wheels. A shroud system connected to the modules prevents substantial escape of contaminating liquids and debris into the environment. 14 figs.

03 NATURAL GAS

0302 Reserves, Geology, and Exploration

Refer also to citation(s) 6292, 6293, 6295, 7817

0303 Drilling, Production, and Processing

Refer also to citation(s) 6206, 6207, 6300

6311 (DOE/CE/40938–1) **Collection of VLE data for acid gas-alkanolamine systems using Fourier transform infrared spectroscopy: Phase 1, September 29, 1990–September 30, 1991.** Bullin, J.A.; Frazier, R.E. Texas A and M Univ., College Station, TX (United States). Texas Engineering Experiment Station. Sep 1991. 15p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FC02-90CE40938. Order Number DE92004027. Source: OSTI; NTIS; GPO Dep.

The industrial standard process for the purification of natural gas is to remove acid gases, mainly hydrogen sulfide and carbon dioxide, by the absorption and reaction of these gases with alkanolamines. Inadequate data for vapor – liquid equilibrium (VLE) hinder the industry from converting operations to more energy efficient amine mixtures and conserving energy. Some energy reductions have been realized in the past decade by applying such amine systems as "hindered" amines, methyldiethanolamine (MDEA), and MDEA based amine mixtures. However, the lack of reliable and accurate fundamental VLE data impedes the commercial application of these more efficient alkanolamine systems. The first project objective is to improve the accuracy of vapor – liquid equilibrium measurements at low hydrogen sulfide concentrations. The second project objective is to measure the VLE for amine mixtures. By improving the accuracy of the VLE measurements on MDEA and mixtures with other amines, energy saving can be quickly and confidently implemented in the many existing absorption units already in use. If about 25% of the existing 95.3 billion SCFD gas purification capacity is converted to these new amine systems, the energy savings are estimated to be about 3×10^{14} BTU/yr.

6312 **Sweetening of sulfur-containing gases using ozone.** Ortega, P.C.; Verona, D.; Cabrera, L.M. To Intevep, SA (Venezuela). 9 Aug 1991. Filed date 9 Feb 1990. Canada Patent patent application 2009754. 30p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $4.00 CAN; MF $2.75 CAN.

A process is provided for removing significant amounts of oxidizable sulfur-containing compounds from a feed gas using ozone and a liquid scrubbing composition to obtain a gas having a reduced sulfur content. Suitable scrubbing compositions include aqueous solutions such as ammonia solutions, and aqueous alkali or alkaline earth metal carbonate suspensions. The process also yields a sulfate-containing compound suitable for use as an agricultural fertilizer such as ammonium sulfate, or as a building material such as gypsum. The process can be operated at approximately ambient temperature and at a relatively low pressure, although elevated temperatures and pressures can also be utilized. A catalyst is not required. The feed gas can be sour natural gas, flue gas from the combustion of organic material, gases produced as byproducts of petroleum processes, and the like. As this feed gas is conmingled with ozone or an ozone-containing gas, sulfur oxides are produced which are converted to the corresponding sulfates in the scrubbing composition to obtain a product solution. Optionally, an oxygen-containing gas can be subsequently passed through the product solution to oxidize any bisulfate ions present to sulfate ions. Experiments are described to illustrate the process of the invention. 3 figs., 3 tabs.

0304 Products and By-Products

6313 (DOE/CE/15459–T4) **Natural gas conversion process: Fourth quarterly report.** Gondouin, M. S-Cal Research Corp., San Rafael, CA (United States). [1991]. 6p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract

FG01-90CE15459. Order Number DE92000397. Source: OSTI; NTIS; GPO Dep.

Work continued on Task No. 3. Particular attention was given to the back pressure control at the two gaseous effluent outlets and to the incineration of these effluents prior to their disposal. Temperature of the riser/regenerator and steam requirements were predicted from the gasification kinetics of coke and of coal char experimentally determined at atmospheric pressure, but at somewhat lower temperatures by H. Heinemann. The results of interactions of CH4 molecules with a Hydrogen Plasma in the adsorbed layer at the surface of refractory oxides were compared with those in the gas phase in order to select the optimum temperature range in the Cyclone reactor.

0305 Health and Safety

Refer also to citation(s) 6316

0306 Economic, Industrial, and Business Aspects

Refer also to citation(s) 6303, 6304, 6305, 6811, 6821

0307 Waste Management

Refer also to citation(s) 6562

0308 Environmental Aspects

Refer also to citation(s) 6306, 6307, 6792

0320 Transport, Handling, and Storage

Refer also to citation(s) 6310

6314 **LPG [liquefied petroleum gas] tank control valve system.** Guenther, M.J.J. 23 Aug 1991. Filed date 23 Feb 1990. Canada Patent patent application 2010880. 31p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $4.00 CAN; MF $2.75 CAN.

A multi-functional control valve system for a liquefied petroleum gas (LPG) tank comprises, on a single frame, the following components. A fill port is used to deliver LPG from a supply source to the tank, and has a manual shutoff valve. A delivery port, independent of the fill port, is provided for passing LPG from the tank to a delivery line for utilization at a location remote from the tank. This port also has a manual shutoff valve. A fuel level monitor is associated with a frame responsive to the level of LPG in the tank. An automatic shutoff associated with the fuel level monitor is positioned in the fill port automatically to move to close the fill port and stop delivery of LPG to the tank when the fuel in the tank reaches a predetermined level. The shutoff is automatically releaseable from that closed position when LPG in the tank falls below that level, as indicated by the monitor. This valve system provides in one compact frame, which may be readily fitted or retrofitted to a tank, many desirable features for safe and convenient LPG tank operation. 10 figs.

6315 **Tower supported gas transmission line.** Williamson, V.A. 19 Aug 1991. Filed date 19 Feb 1990. Canada Patent patent application 2010300. 7p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $4.00 CAN; MF $2.75 CAN.

In a system for the overland transmission of natural gas or other gas, a gas-inflated polymer film tube is used with or without parallel support in a suspension bridge interlinked series between metal transmission towers, with gas transmission velocity maintained by gas compressor stations up to 100 miles apart. Two such systems are disclosed: a non-rope-supported system in which the tensile strength of the tube itself is sufficient for it to be self-supportive as a bridge while also functioning as a full lengthwise tower guyline support; and a parallel rope-supported system with guy wires holding crossline strains from drilled or buried anchorages. The tubes are made of fluoropolymer films and are made up by traditional methods of gluing together flexible polymer film in continuous panels to produce a tube form. If 12-mil polyvinyl fluoride film is used at a gas pressure of 3.6 lb/in^2, a 10-ft diameter tube between compression stations will produce a gas velocity of 339 ft/s, will transmit 3.4 billion ft^3/d of gas, and can withstand wind pressures produced at wind velocities up to 136 mph. The polyvinyl fluoride material retains mechanical toughness, outstanding weatherability, flexibility, and impact resistance without tearing in temperatures ranging from −100 to 225°F. 1 fig.

6316 **Method of adding a malodorant to gases.** Suominen, T.; Smars, E. To AGA (Sweden). 9 Aug 1991. Filed date 9 Feb 1990. Canada Patent patent application 2009716. 9p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $4.00 CAN; MF $2.75 CAN.

A method is provided for adding an odorant to a consumer gas in order to warn of the existence of a gas leak. The process employs a concentrated gas, called a master gas, in which the odorant is dissolved. The master gas is selected such that the odorant does not condense during transport and storage of the master gas at low temperatures. The odorant is dissolved in the liquid master gas in a pressure vessel to obtain a solution which essentially comprises a gaseous phase and a liquid phase. The master gas is extracted from the liquid phase, vaporized, and added to the gas which is intended to be odorized. When the odorant is dimethyl sulfide, the odorant is used in a concentration of 1-15%, and the extracted vaporized solution is supplied to the consumer gas such that the odorant is present in a concentration of 5-50 ppM. In this case, if the master gas is liquid carbon dioxide, the odorant will remain soluble throughout a temperature range of −40°C to 50°C.

04 OIL SHALES AND TAR SANDS

0402 Reserves, Geology, and Exploration

Refer also to citation(s) 7817

0403 Drilling, Fracturing, and Mining

Refer also to citation(s) 6300

0404 Oil Production, Recovery, and Refining

Refer also to citation(s) 6134, 6301

6317 (DOE/BC/14479–7) **Chemically assisted in situ recovery of oil shale: Technical progress report, April 1, 1991–June 30, 1991.** Ramirez, W.F. Colorado Univ., Boulder, CO (United States). Dept. of Chemical Engineering. [1991]. 5p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-89BC14479. Order Number DE92003697. Source: OSTI; NTIS; GPO Dep.

The objective of this work is to investigate, in the laboratory, the parameters associated with a chemically assisted in situ recovery procedure, using hydrogen chloride (HCl), carbon dioxide (CO_2), and steam (H_2O), to obtain data useful to develop a process more economic than existing processes and to report all findings. Quarter summary: all modifications previously planned where completed and a reaction experiment was run. A couple design flaws were discovered, improvements were designed, and all parts are expected in the first week of July. Experiment #6 is expected to run the following Monday. Barring further mishap, experiments will be run one each week thereafter. The project is behind schedule, but the project is well positioned to make significant and considerable progress.

0409 Waste Management

6318 (DOE/MC/11076–3019) **Organic and inorganic hazardous waste stabilization using combusted oil shale.** Sorini, S.S.; Lane, D.C. Western Research Inst., Laramie, WY (United States). Apr 1991. 24p. Sponsored by U.S. DOE Fossil Energy.

DOE Contract FC21-86MC11076. Order Number DE91016652. Source: OSTI; NTIS; GPO Dep.

A laboratory study was conducted at the Western Research Institute to evaluate the ability of combusted oil shale to stabilize organic and inorganic constituents of hazardous wastes. The oil shale used in the research was a western oil shale retorted in an inclined fluidized-bed reactor. Two combustion temperatures were used, 1550°F and 1620°F (843°C and 882°C). The five wastes selected for experimentation were an API separator sludge, creosote-contaminated soil, mixed metal oxide/hydroxide waste, metal-plating sludge, and smelter dust. The API separator sludge and creosote-contaminated soil are US EPA-listed hazardous wastes and contain organic contaminants. The mixed metal oxide/hydroxide waste, metal-plating sludge (also an EPA-listed waste), and smelter dust contain high concentrations of heavy metals. The smelter dust and mixed metal oxide/hydroxide waste fail the Toxicity Characteristic Leaching Procedure (TCLP) for cadmium, and the metalplating sludge fails the TCLP for chromium. To evaluate the ability of the combusted oil shales to stabilize the hazardous wastes, mixtures involving varying amounts of each of the shales with each of the hazardous wastes were prepared, allowed to equilibrate, and then leached with deionized, distilled water. The leachates were analyzed for the hazardous constituent(s) of interest.

05 NUCLEAR FUELS

Refer also to citation(s) 6476, 7134

6319 (INIS-GB-385) **Fifth annual plutonium figures published.** Department of Energy, London (United Kingdom). 17 Oct 1991 6p. Order Number DE92615027. Source: OSTI; NTIS (US Sales Only); INIS.

The Department of Energy figures for 1990/91 on the plutonium produced at Britain's civil nuclear power stations, reprocessing activities at Sellafield, and the civil plutonium stocks are given. These figures are published annually and are compiled from data supplied by Nuclear Electric plc, Scottish Nuclear Ltd, British Nuclear Fuels plc (BNFL) and the United Kingdom Atomic Energy Authority (UKAEA). Reactor discharges and dispatches from site of irradiated fuel and the stocks of plutonium held in irradiated fuels are listed. BNFL figures show the cumulative stocks of plutonium held in irradiated fuels. 156 kg of separated plutonium was imported from France under the first reactor collaboration. 2210 kg of unseparated plutonium was imported as irradiated fuel. (author).

0501 Reserves, Exploration, and Mining

6320 (CNIC-00449) **Using geoelectrochemical technique to extract uranium and other metals.** Gao Yulong (No.240 Research Inst. of North-East Bureau of Geologic Exploration of Nuclear Industry, Shenyang, LN (China)). China Nuclear Information Centre, Beijing, BJ (China). Oct 1990. 11p. (In Chinese). (NEGE-0001.). Order Number DE92614880. Source: OSTI; NTIS (US Sales Only); INIS.

The geoelectrochemical extraction technique, which is a direct deep exploring method, is one of the geoelectrochemical exploring methods. It is developed recently to explore basic metals, precious metals, rare metals and some nonmetal mineral products. It is also a combination of electrical surveying and geochemical surveying. This method is more useful in the seeking of gold ore deposit. The principle and technique of this method and the results in seeking gold, uranium, lead, nickel and tin ore deposits are introduced. The equipment and instruments used in this method are also given.

6321 (INIS-BR-2854) **Stratigraphy, tectonic and ore potential of pre-cambrian unities from Serro region-MG (Mato Grosso quadrangle).** Assis, L.C. de. Brasilia Univ., DF (Brazil). Dept. de Geociencias. 1982 158p. (In Portuguese). Order Number DE92613469. Source: OSTI; NTIS (US Sales Only); INIS.

Geological and stratigraphic elements of the Proterozoic units of the Serro region, Mato Grosso Quadrangle, show the absence of the faciological transition between the Espinhaco Group and the Minas Supergroup. Occurs in this region is a lithostratigraphical sequence of four distinct units: the Crystalline Basement; the Volcano-Sedimentary Sequence of Serro; the Minas Supergroup. The ore potential of the region includes: quartz veins, within the Galho do Miguel Formation; diamond, within the Sopa conglomerates; gold, in alluvial deposits and remobilized in quartz veins of the Sopa-Brumadinho Formation; bauxite, in the metabasics; uranium in the metaconglomerates of Moeda Formation; iron, in Caue Formation; chromium, gold and base metals in the Volcano-Sedimentary Sequence of Serro. Emphasis is given to the characterization of the Volcano-Sedimentary Sequence of Serro and its mineralization that is characterized as a stratiform massif with important volcano-sedimentary contribution, possible, a greenstone belt, with high gold-bearing potential. (author).

6322 (INIS-BR-2874) **Uranium recovery from phosphate rocks concentrated.** Azevedo, M.F. de. Universidade Federal, Rio de Janeiro, RJ (Brazil). Inst. de Quimica. 1986 62p. (In Portuguese). Order Number DE92613470. Source: OSTI; NTIS (US Sales Only); INIS.

The reserves, geological data, chemical data and technical flowsheet from COPEBRAS and Goiasfertil ores are described, including the process of mining ore concentration. Samples of Goiasfertil ores are analysed by gravimetric analysis, for phosphate, and spectrofluorimetry for uranium. (author).

6323 (INIS-mf-13064) **Methodology of simultaneous analysis of Uranium and Thorium by nuclear and atomic techniques. Application to the Uranium and Thorium dosing in mineralogic samples.** Fakhi, S. (Universite Mohammed 5, Rabat (Morocco). Faculte des Sciences). Universite Mohammed 5, Rabat (Morocco). Faculte des Sciences. 15 Apr 1988 193p. (In French). Order Number DE92613471. Source: OSTI; NTIS (US Sales Only); INIS.

This work concerns essentially the potential applications of 100 kW nuclear reactor of Strasbourg Nuclear Research Centre to neutron activation analysis of Uranium and Thorium. The Uranium dosing has been made using: 239-U, 239-Np, fission products or delayed neutrons. Thorium has been showed up by means of 233-Th or 233-Pa. The 239-U and 233-Th detection leads to a rapid and non-destructive analysis of Uranium and Thorium. The maximum sensitivity is of 78 ng for Uranium and of 160 ng for Thorium. The Uranium and Thorium dosing based on 239-Np and 233-Pa detection needs chemical selective separations for each of these radionuclides. The liquid-liquid extraction has permitted to elaborate rapid and quantitative separation methods. The sensitivities of the analysis after extraction reach 30 ng for Uranium and 50 ng for Thorium. The fission products separation study has allowed to elaborate the La, Ce and Nd extractions and its application to the Uranium dosing gives satisfying results. A rapid dosing method with a sensitivity of 0.35 microgramme has been elaborated with the help of delayed neutrons measurement. These different methods have been applied to the Uranium and Thorium dosing in samples coming from Oklo mine in Gabon. The analyses of these samples by atomic absorption spectroscopy and by the proton induced X-ray emission (PIXE) method confirm that the neutron activation analysis methods are reliable. 37 figs., 14 tabs., 50 refs.

0504 Feed Processing

Refer also to citation(s) 7039, 7050

6324 (CNIC-00395) **The exploration on the new process of hydrofluorination of uranium dioxide.** Zhao Jun (Tianjin Univ. (China)); Zhao Siyuan; Shen Guohong. China Nuclear Information Centre, Beijing, BJ (China). Apr 1990. 11p. (In Chinese). (TU-0010.). Order Number DE92613387. Source: OSTI; NTIS (US Sales Only); INIS.

The optimum treatment of the reaction conditions were achieved based on the kinetic data of the hydrofluorination of uranium dioxide (material obtained from uranyl nitrate by one step denitration-reduction process) and the flow characteristic of reactor. A new process is proposed that is the stirred bed (exhaust gas section) in series with fluidized bed (production section). The optimum design and experimental study of operation conditions of the stirred bed reactor have been completed. The results of hot modelling test of the stirred bed reactor showed that the conversion of UO_2 to UF_4 in the exit stream was 47≈50% and the hydrogen fluoride remaining in the exhaust gas was less than 5%. Comparision with the circuit of two fluidized beds in series showed that the conversion of stirred bed was nearly same as the first fluidized bed but the hydrogen fluoride remaining in the exhaust gas was considerably decreased.

6325 (CNIC–00426) **Ion exchange resin fouling of molybdenum in recovery uranium processess.** Zhang Guowei (Beijing Research Inst. of Uranium Ore Processing (China)); Zhao Guirong. China Nuclear Information Centre, Beijing, BJ (China). Sep 1990. 13p. (In Chinese). (BRIUOP–0011.). Order Number DE92613388. Source: OSTI; NTIS (US Sales Only); INIS.

The relationship between anion exchange resin fouling and molybdic acid polymerization was studied. By using potentiometer titration and laser-Raman spectroscopy the relationship of molybdic acid polymerization and the pH value of solution or the molybdenum concentration was determined. It was shown that as the concentration of initial molybdenum in solution decreases from 0.2 mol/L to 0.5 mmol/L, the pH value of starting polymerization decreased from 6.5 to 4.5. The experimental results show that the fouling of 201 x 7 resin in the acidic solution is mainly caused by the adsorbing of $Mo_3O_{26}^{4-}$ ion and occupying the exchange radical site of the resin. Under the leaching conditions the molybdenum and phosphate existing in the leaching liquor can form 12-molybdophosphate ion. It also leads to resin fouling. The molybdenum on the fouled resin can synergically be desorbed by mixed desorbents containing ammonium hydroxide and ammonium sulfate. The desorbed resin can be used for uranium adsorption and the desorbed molybdenum can be recovered by ion exchange method.

6326 (CNIC–00430) **Ferric sulphate leaching process for uranium ore.** Cai Ximin (Beijing Research Institute of Chemical Engineering and Metallurgy (China)). China Nuclear Information Centre, Beijing, BJ (China). Sep 1990. 8p. (In Chinese). (BICM–0001.). Order Number DE92613389. Source: OSTI; NTIS (US Sales Only); INIS.

A process using the ferric sulphate solution as a leaching agent to the uranium ore which was exploited in the south part of Hunan province was studied. The ore mainly contains uraninite. Comparing with the conventional sulphuric acid leching method, this process reduced the acid consumption about 30≈40%, and dissolved solids 15≈20%. The ferric leaching agent can cyclically be used by the ferrous oxidant bacteria. From the results of six cycles, it indicated that the ferric leaching ageng does not interfere the leaching results of uranium.

6327 (ORNL/TM–11792) **Reaction of uranium oxides with chlorine and carbon or carbon monoxide to prepare uranium chlorides.** Haas, P.A.; Lee, D.D.; Mailen, J.C. Oak Ridge National Lab., TN (United States). Nov 1991. 61p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE92004886. Source: OSTI; NTIS; GPO Dep.

The preferred preparation concept of uranium metal for feed to an AVLIS uranium enrichment process requires preparation of uranium tetrachloride (UCl_4) by reacting uranium oxides (UO_2/UO_3) and chlorine (Cl_2) in a molten chloride salt medium. UO_2 is a very stable metal oxide; thus, the chemical conversion requires both a chlorinating agent and a reducing agent that gives an oxide product which is much more stable than the corresponding chloride. Experimental studies in a quartz reactor of 4-cm ID have demonstrated the practically of some chemical flow sheets. Experimentation has illustrated a sequence of results concerning the chemical flow sheets. Tests with a graphite block at 850°C demonstrated rapid reactions of Cl_2 and evolution of carbon dioxide (CO_2) as a product. Use of carbon monoxide (CO) as the reducing agent also gave rapid reactions of Cl_2 and formation of CO_2 at lower temperatures, but the reduction reactions were slower than the chlorinations. Carbon powder in the molten salt melt gave higher rates of reduction and better steady state utilization of Cl_2. Addition of UO_2 feed while chlorination was in progress greatly improved the operation by avoiding the plugging effects from high UO_2 concentrations and the poor Cl_2 utilizations from low UO_2 concentrations. An UO_3 feed gave undesirable effects while a feed of UO_2-C spheres was excellent. The UO_2-C spheres also gave good rates of reaction as a fixed bed without any molten chloride salt. Results with a larger reactor and a bottom condenser for volatilized uranium show collection of condensed uranium chlorides as a loose powder and chlorine utilizations of 95–98% at high feed rates. 14 refs., 7 figs., 14 tabs.

0505 Uranium Enrichment

Refer also to citation(s) 6327, 6362, 6395

6328 (NUREG/CR–5734) **Recommendations to the NRC on acceptable standard format and content for the Fundamental Nuclear Material Control (FNMC) Plan required for low-enriched uranium enrichment facilities.** Moran, B.W. (Oak Ridge K-25 Site, TN (United States)); Belew, W.L.; Hammond, G.A.; Brenner, L.M. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Safeguards and Transportation; Oak Ridge K-25 Site, TN (United States); 21st Century Industries, Inc., Gaithersburg, MD (United States). Nov 1991. 45p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OT21400. (K/ITP–415). Source: OSTI; NTIS; INIS; GPO.

A new section, 10 CFR 74.33, has been added to the material control and accounting (MC&A) requirements of 10 CFR Part 74. This new section pertains to US Nuclear Regulatory Commission (NRC)-licensed uranium enrichment facilities that are authorized to produce and to possess more than one effective kilogram of special nuclear material (SNM) of low strategic significance. The new section is patterned after 10 CFR 74.31, which pertains to NRC licensees (other than production or utilization facilities licensed pursuant to 10 CFR Part 50 and 70 and waste disposal facilities) that are authorized to possess and use more than one effective kilogram of unencapsulated SNM of low strategic significance. Because enrichment facilities have the potential capability of producing SNM of moderate strategic significance and also strategic SNM, certain performance objectives and MC&A system capabilities are required in 10 CFR 74.33 that are not contained in 10 CFR 74.31. This document recommends to the NRC information that the licensee or applicant should provide in the fundamental nuclear material control (FNMC) plan. This document also describes methods that should be acceptable for compliance with the general performance objectives. While this document is intended to cover various uranium enrichment technologies, the primary focus at this time is gas centrifuge and gaseous diffusion.

0507 Fuels Production and Properties

Refer also to citation(s) 6341, 6349, 6353, 6602, 6603, 6645, 6668, 6976, 6977, 7037, 7047, 7135

6329 (DOE/NS–0002P) **Report of an investigation into deterioration of the Plutonium Fuel Form Fabrication Facility (PuFF) at the DOE Savannah River Site.** USDOE Office of Nuclear Safety, Washington, DC (United States). Oct 1991. 160p. Sponsored by U.S. DOE Nuclear Safety. Order Number DE92002946. Source: OSTI; NTIS; INIS; GPO Dep.

This investigations of the Savannah River Site's Plutonium Fuel Form fabrication facility located in Building 235-F was initiated in April 1991. The purpose of the investigation was to determine whether, as has been alleged, operation of the facility's argon inert gas system was terminated with the knowledge that continued inoperability of the argon system would cause accelerated corrosion damage to the equipment in the plutonium 238 processing cells. The investigation quickly established that the decision to discontinue operation of the argon system, by not repairing it, was merely one of the measures, and not the most important one, which led to the current deteriorated state of the facility. As a result, the scope of the investigation was broadened to more identify and assess those factors which contributed to the facility's current condition. This document discusses the backgrounds, results, and recommendations of this investigation.

6330 (HAN–42598-Del.) **Weekly report for period February 1 to February 7, 1950 inclusive.** Christy, J.T. Hanford Works, Richland, WA (United States). 8 Feb 1950. 100p. Sponsored by

U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE92003707. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document provides the 200 area monthly reports for the time period of February 1950 through October 1950. It also contains weekly reports for the time period of February 1, 1950 through November 28, 1950. (FI)

6331 (HW–49419-C-Del.) **Chemical research and development monthly report and quarterly synopsis, March 1957.** Cooper, V.R. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 4 Apr 1957. 40p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE92002845. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report summarizes the activities of the departments concerned with chemical research, chemical development, analytical laboratories, engineering development planning, and chemical effluents technology. 5 tabs. (WET)

6332 (HW–50266-RD-Del.) **Separation plant effluent gas measurements for determining plutonium production rate.** Schwendiman, L.C. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 20 May 1957. 14p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE92004558. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The use of ion chambers or proportional beta counters is recommended for the measurement of Kr^{85} in separations plant gaseous effluent. It will be necessary to evaluate the Xe^{133} present if short cooling times (less than about 90 days) since irradiation are used. This can be accomplished through calibration and decay measurements. It is concluded that the Kr^{85} evolution could be determined to about ±5% with careful measurements.

6333 (WHC-SA–1379) **Calculation of the Fast Flux Test Facility fuel pin tests with the WIMS-E and MCNP codes.** Schwinkendorf, K.N.; Wittekind, W.D.; Toffer, H. Westinghouse Hanford Co., Richland, WA (United States). Oct 1991. 13p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-87RL10930. (CONF-920308–5: Advances in reactor physics, Charleston, SC (United States), 8-11 Mar 1992). Order Number DE92002915. Source: OSTI; NTIS; INIS; GPO Dep.

The Fuel Assembly Area (FAA) at the Fast Flux Test Facility site on the Hanford Site at Richland, Washington currently is being prepared to fabricate mixed oxide fuel (U, Pu) for the FFTF. Calculational tools are required to perform criticality safety analyses for various process locations and to establish safe limits for fissile material handling at the FAA. These codes require validation against experimental data appropriate for the compositions that will be handled. Critical array experiments performed by Bierman provide such data for mixed oxide fuel in the range Pu/(U+Pu) = 22 wt %, and with Pu-240 contents equal to 12 wt %. Both the Monte Carlo Neutron Photon (MCNP) and the Winfrith Improved Multigroup Scheme (WIMS-E) computer codes were used to calculate the neutron multiplication factor for explicit models of the various critical arrays. The W-CACTUS modules within the WIMS-E code system was used to calculate k_∞ for the explicit array configuration, as well as few-group cross sections that were then used in a three-dimensional diffusion theory code for the calculation of k_{eff} for the finite array. 10 refs., 15 figs., 7 tabs.

0508 Spent Fuels Reprocessing

Refer also to citation(s) 6330, 6605, 7037, 7108, 7109, 7111, 7122, 7775

6334 (DOE/RL–90-24-Vol.1-Rev.1) **PUREX Storage Tunnels dangerous waste permit application: Revision 1, Volume 1.** USDOE Richland Operations Office, WA (United States). Dec 1991. 262p. Sponsored by U.S. DOE Defense Programs; U.S. DOE Environment Safety & Health. DOE Contract AC06-87RL10930. Order Number DE92004155. Source: OSTI; NTIS; INIS; GPO Dep.

The PUREX Storage Tunnels are a mixed waste storage unit consisting of two underground railroad tunnels: Tunnel Number 1 designated 218-E-14 and Tunnel Number 2 designated 218-E-15. The two tunnels are connected by rail to the PUREX Plant and combine to provide storage space for 48 railroad cars (railcars). The PUREX Storage Tunnels provide a long-term storage location for equipment removed from the PUREX Plant. Transfers into the PUREX Storage Tunnels are made on an as-needed basis. Radioactively contaminated equipment is loaded on railcars and remotely transferred by rail into the PUREX Storage Tunnels. Railcars act as both a transport means and a storage platform for equipment placed into the tunnels. This report consists of part A and part B. Part A reports on amounts and locations of the mixed water. Part B permit application consists of the following: Facility Description and General Provisions; Waste Characteristics; Process Information; Groundwater Monitoring; Procedures to Prevent Hazards; Contingency Plan; Personnel Training; Exposure Information Report.

6335 (ESG-DOE–13276) **AIROX dry reprocessing of uranium oxide fuels.** Hoyt, R.C. (Rockwell International Corp., Canoga Park, CA (United States). Energy Systems Group); Grantham, L.F.; Clark, R.G.; Twichell, P.W. Rockwell International Corp., Canoga Park, CA (United States). Energy Systems Group; Argonne National Lab., IL (United States). 12 Jul 1979. 118p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AT03-76SF70013 ;W-31109-ENG-38. Order Number DE92004037. Source: OSTI; NTIS; GPO Dep.

The AIROX pyrochemical dry reprocessing method has been shown to be a highly proliferation resistant means of utilizing fissile material in spent nuclear fuel. Fuel cycles based upon this reprocessing method have been developed for both LWR and FBR fuel. Process analysis with computer codes has determined the relative importance of removing specific fission products and has established that new fuel management strategies need to be developed for fuels recycles with fission products. Process conditions have been optimized with respect to pellet pulverization and reaction rates by performing tests on unirradiated UO_2. These tests yielded a product which is sufficiently pulverized for complete decladding, without production of extremely fine particles to cause dusting problems. An analysis has indicated that the product should not be contaminated with cladding material, and that waste treatment can be accomplished with the technology being developed for aqueous processing facilities. It appears that waste produced during dry reprocessing will be significantly easier to treat and consist of smaller volumes than those produced by conventional aqueous reprocessing facilities.

6336 (ESG-DOE–13277) **Review of the literature for dry reprocessing oxide, metal, and carbide fuel: The AIROX, RAHYD, and CARBOX pyrochemical processes.** Hoyt, R.C. (Rockwell International Corp., Canoga Park, CA (United States). Energy Systems Group); Rhee, B.W. Argonne National Lab., IL (United States); Rockwell International Corp., Canoga Park, CA (United States). Energy Systems Group. 30 Sep 1979. 226p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AT03-76SF70013. Order Number DE92004038. Source: OSTI; NTIS; GPO Dep.

The state of the art of dry processing oxide, carbide, and metal fuel has been determined through an extensive literature review. Dry processing in one of the most proliferation resistant fuel reprocessing technologies available to date, and is one of the few which can be exported to other countries. Feasibility has been established for oxide, carbide, and metal fuel on a laboratory scale, and large-scale experiments on oxide and carbide fuel have shown viability of the dry processing concept. A complete dry processing cycle has been demonstrated by multicycle processing-refabrication-reirradiation experiments on oxide fuel. Additional experimental work is necessary to: (1) demonstrate the complete fuel cycle for carbide and metal fuel, (2) optimize dry processing conditions, and (3) establish fission product behavior. Dry process waste management is easier than for an aqueous processing facility since wastes are primarily solids and gases. Waste treatment can be accomplished by techniques which have been, or are being, developed for aqueous plants.

6337 (HW–7-5538-Del.) **Hanford Engineer Works technical progress letter No. 129, December 15–21, [1946].** Greninger, A.B. Hanford Works, Richland, WA (United States). 26 Dec 1946.

13p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE92004548. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This technical progress report summarizes work at the Hanford Engineer Works' 100 Areas, 300 Area, 200 Areas for December 15, 1946 through December 21, 1946. (JL)

6338 (HW-7-5708-Del.) **Hanford Engineer Works technical progress letter No. 134, January 19–25, [1947].** Greninger, A.B. Hanford Works, Richland, WA (United States). 30 Jan 1947. 12p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE92004550. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This technical progress letter contains reports from six Technical Department divisions at the Hanford Engineer Works for January 19 through January 25, 1947. The six reporting divisions are: 100 Areas, 300 Area, 200 Areas, Chemical Development, Laboratories, and Statistical Studies. (JL)

6339 (HW-7-5821-Del.) **Hanford Engineer Works technical progress letter No. 137, February 9–15, [1947].** Greninger, A.B. Hanford Works, Richland, WA (United States). 20 Feb 1947. 12p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE92004549. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This technical progress letter contains reports from six Technical Department divisions at the Hanford Engineer Works for February 9, through February 15, 1947. The six reporting divisions are: 100 Areas, 300 Area, 200 Areas, Chemical Development, Laboratories, and Statistical Studies.

6340 (HW-7-5853-Del.) **Hanford Engineer Works technical progress letter No. 138, February 16–22, [1947].** Greninger, A.B. Hanford Works, Richland, WA (United States). 27 Feb 1947. 12p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE92004551. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This technical progress letter contains reports from six Technical Department divisions at the Hanford Engineer Works for February 16 through February 22, 1947. The six reporting divisions are: 100 Areas, 300 Area, 200 Areas, Chemical Development, Laboratories, and Statistical Studies. (JL)

6341 (HW–10488) **291-T emergency exhaust air scrubbers.** Stainken, F.A.R. Hanford Works, Richland, WA (United States). 16 Jul 1948. 3p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE92005504. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Short communication. SCRUBBERS/construction; SCRUBBERS; CONSTRUCTION; EXHAUST SYSTEMS; HAPO; RADIOACTIVE EFFLUENTS

6342 (HW–31005) **A brief review of major problems at Redox.** Maider, J.E. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 2 Mar 1954. 4p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE92004552. Source: OSTI; NTIS (US Sales Only); GPO Dep.

During the last few months the Redox plant has been plagued with an excessive number of problems which have resulted in its inability to meet forecasted production schedules in November 1953, January and February 1954. The following paragraphs are intended to indicate some of the problems faced at Redox and the steps that are being taken to remedy them. It should be emphasized that the plant has been operating far above original design capacity and this fact tends to aggravate some of the problems. For example, although steps have been taken to increase the throughput capacity of certain of the head-end steps and some of the columns, it is most possible to install a second centrifuge, oxidizer or D-12 waste evaporator in parallel so that when any of these – one of a kind – pieces of equipment is out of service the entire plant is unable to operate.

6343 (HW–31417) **Redox Plant—Ruthenium contamination control.** Maider, J.E. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 9 Apr 1954. 3p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE92004553. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report discusses ruthenium releases from the Redox plant in 1954. Plans for the controlling the release of ruthenium to the stack is summarized. (JL)

6344 (HW–31514) **Redox Plant—Ruthenium contamination control.** Maider, J.E. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 19 Apr 1954. 2p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE92004554. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This paper briefly reaccounts principal progress items addressed at a April 1954 meeting on ruthenium release and abatement measures for the Redox Plant at the Hanford Engineer Works. (JL)

6345 (HW–32056) **Redox Plant—Ruthenium contamination control.** Maider, J.E. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 7 Jun 1954. 2p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE92004555. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report consists of a brief memo discussing ruthenium release,and abatement measures at the Redox Plant in 1954. (JL)

6346 (HW–34216) **Redox decontamination performance.** Irish, E.R. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 23 Dec 1954. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE92004977. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Since start-up of the Redox Plant, different types of decontamination difficulties have been experienced and corrective measures taken. Current decontamination performance is superior to that ever experienced before. However, with the apparent need for the for elimination of the permanganate Head-End process for the IAF oxidation, several modifications to the plant flowsheet and equipment have been planned in order to obtain satisfactory overall decontamination without permanganate Head-End. The objectives of the memorandum are: to summarize generally and briefly the decontamination experience of the Redox process operating on IAF oxidized by sodium dichromate; to indicate the decontamination which probably can be obtained with the new Phase 2 equipment and its improved performance; and to re-evaluate the timing and feasibility of the current approaches for solving the long-range Redox decontamination problems arising as a result of oxidation of IAF by sodium dichromate (vice potassium permanganate).

6347 (HW–35445) **Items for over-all Redox contamination improvement.** Rohrmann, C.A.; Wilson, B.D.; Merrill, E.T. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 13 Jan 1955. 10p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE92004557. Source: OSTI; NTIS (US Sales Only); GPO Dep.

In view of contamination difficulties within the Redox operation, number of items are being considered to improve this situation. It is the objective of this document to list and describe seven times which it is felt would contribute most toward improvement. It is also an objective to present for RDS-D-12 Group consideration the recommendations of representatives from Manufacturing, Technical, and Design in these matters with the expectation that a project proposal written in general terms for overall contamination improvement would be prepared.

6348 (HW–50241) **Flowsheet No. 1: Cesium isolation and packaging.** Wirta, R.W.; Koski, O.H. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 20 May 1957. 7p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE92003505. Source: OSTI; NTIS (US Sales Only); GPO Dep.

An engineering flowsheet has been prepared for the conversion of an aqueous slurry of cesium-zinc-ferrocyanide into a dry cesium chloride product by the calcination process. Flowsheet No. 1 defines a six-step batch-type calcination operation for processing the slurry into a dry powder for offsite shipment in bulk containers. Some of the advantages to this process are as follows: Product losses are expected to be small, estimated to be less than 0.03 percent; the equipment required to process a given number of curies per batch appears to be relatively small, compact, and simple; the process does not impose severe requirements for materials of construction; and requirements for process control and instrumentation are expected to be simple. There are two disadvantages to this process. First, the cesium-zinc-ferrocyanide precipitate is not considered economically filterable, hence, the separation of solids from liquids is encumbered. Second, the process, as outlined, if potentially hazardous because of the possible nitrate carry-over with the influent slurry. This nitrate may cause a rapid reaction in the calcination step. It is concluded that this flowsheet offers a satisfactory scheme for isolating radiocesium if the process is modified to preclude the possibility of nitrates or other unwanted oxidants from reaching the calcination step. 1 fig.

6349 (HW–54005) **A plant weekly summary—Purex operation, January 6, 1958–December 29, 1958.** Schroeder, O.C. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 6 Jan 1958. 51p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE92004559. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report contains the weekly summaries for the Purex process at the Hanford Engineer Works for January 6, 1958 to December 29, 1958. Each summary includes uranium production, maximum operating rate, and waste loss statistics as well as an operating experience briefing. (JL)

6350 (HW–55014-RD) **E-metal dissolvers, Redox.** Tomlinson, R.E. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 19 Feb 1958. 10p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE92004560. Source: OSTI; NTIS (US Sales Only); GPO Dep.

In December 1957, the proposal for Project CG-772, "E-Metal Dissolvers – Redox" was returned for reconsideration in order that the units might be designed to accommodate higher enrichment fuels, if practical. Alternate design approaches have been under consideration since that time. It is the purpose of this document to summarize the parameters involved and to present the recommendation developed from the joint thinking of Hanford Laboratories, Research and Engineering, Facilities Engineering, and Redox Operation.

6351 (HW–55455) **Revised definitive process design, E-metal dissolver equipment, Redox Facility.** Graf, W.A. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 31 Mar 1958. 11p. Sponsored by U.S. DOE Environment Safety & Health. DOE Contract AC06-76RL01830. Order Number DE92004561. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of this report is to present the revised process design to be used as the basis for the detail design of Redox dissolvers each of which shall meet the following: Process irradiated natural uranium slugs (standard Hanford or I&E type) at 43% of Phase II Redox production rates; process irradiated enriched uranium up to .94% U^{235} isotopic content in slugs (standard Hanford or I&E type) at rates up to 43% of Phase II capacity; and process irradiated fuel elements of cluster design from new reactors with cladding material of aluminum or zirconium, enrichments to .94% U^{235} and dimensions of ten feet long and 10 inches square. This report is also to form the basis for slug distribution tests to be performed by HLO concurrent with the final design effort.

6352 (HW–60143) **Definitive process design, Redox multipurpose dissolver installation.** Gustafson, L.D. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 6 May 1959. 14p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE92004562. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document provides the required definitive scope design for dissolver equipment capable of nuclear safe processing by geometry of E-Metal and certain other fuels enriched to a maximum of one per cent U-235 equivalent. Using only a single dissolver installation of this design, it will be possible to process the current E-Metal monthly commitment in less than two weeks (five-day week). The proposed dissolver system is to incorporate design flexibility required to permit conversion to Zirflex processing of NPR fuels.

6353 (HW–89083) **Hanford Site process flow diagrams, 1958.** Gydesen, S.P. (comp.). General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. Dec 1991. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE92004563. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report consists of flow diagrams extracted from the General Managers Data Book and prepared as a separate document that graphically depicts in lay language the site operation in 1958. (JL)

6354 (INIS-mf–13025 vp.) **Actinide extraction chemistry with the amide type of extractants (Preprints no. IT-16).** Musikas, C. (CEA-DCC-DPR-SEMP-SECP, Fontenay-aux-Roses (France)); Condamines, C.; Cuillerdier, C.; Nigond, L. Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. Feb 1991. 685p. (CONF-9102132–: International symposium on radiochemistry and radiation chemistry - plutonium 50, Bombay (India), 4-7 Feb 1991). In *International symposium on radiochemistry and radiation chemistry (plutonium - 50 years) (held at Bombay during February 4-7, 1991): Preprints volume.* Order Number DE92001334. Source: OSTI; NTIS (US Sales Only); INIS.

The extraction chemistry of the actinide ions and the inorganic acids with amides, N,N-dialkylamides (RRNCOR') and N,N'-tetraalkyl 2-alkyl propane diamides $(RR'NCO)_2$ CHR^{bar} is reviewed. Examples of application of those extractants in the separation of the nuclear industry are given. The monoamides are advantageous alternative to tributylphosphate and the diamides useful for the alpha TRU waste decontamination. The most interesting aspect of these extractants are the innocuity of their radiolytic products and the possibility to incinerate the used solvents without large amounts of inorganic residues as for the organophosphorus extractants. (author). 13 refs., 7 tabs., 7 figs.

6355 (INIS-mf–13025 vp.) **Spen fuel reprocessing- a perspective (Preprint no. IT-17).** Kumar, S.V. (Bhabha Atomic Research Centre, Bombay (India). Process Engineering and Systems Division). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. Feb 1991. 685p. (CONF-9102132–: International symposium on radiochemistry and radiation chemistry - plutonium 50, Bombay (India), 4-7 Feb 1991). In *International symposium on radiochemistry and radiation chemistry (Plutonium - 50 years) (held at Bombay during February 4-7, 1991): Preprints volume.* Order Number DE92001334. Source: OSTI; NTIS (US Sales Only); INIS.

The back end of the fuel cycle assumes greater importance to facilitate closing of the fuel cycle. The decision regarding the choice of the fuel cycle is influenced by many factors such as the technology, the economics, the environmental impact, the proliferation risk, the scale of the nuclear programme, the national energy strategy etc. Countries like France, United Kingdom, Germany, USSR, Japan and India have shown preference for the reprocess-recycle option whereas the policy in USA, Canada, Italy, Sweden and Italy is for long term storage keeping wide open the options of reprocessing or disposal at a later date. Some of the technological aspects in this choice are discussed in this paper. (author). 1 tab.

6356 (INIS-mf–13025 vp.) **Developments and automation in purex process control analytical measurement systems (Preprint no. IT-20).** Ramanujam, A. (Bhabha Atomic Research Centre, Bombay (India). Fuel Reprocessing Div.). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. Feb 1991. 685p. (CONF-9102132–: International symposium on radiochemistry and radiation chemistry - plutonium 50, Bombay (India), 4-7 Feb 1991). In *International symposium on radiochemistry and radiation chemistry (Plutonium - 50 years) (held at Bombay during February 4-7, 1991): Preprints volume.* Order Number DE92001334. Source: OSTI; NTIS (US Sales Only); INIS.

The fuel reprocessing facility based on purex process depends on efficient process control analytical measurement systems for its successful operation. The process control laboratory plays a vital role in catering to these requirements. This paper describes the various efforts put in to improve its performance capabilities in three major areas of operation, viz. sample handling, analytical and data processing. In developing automation aids and analytical techniques, apart from the special emphasis put on reduction in personnel exposure to radiation and time required for analysis, due consideration has been given to operational reliability and safety of the system. (author). 15 refs., 4 tabs., 3 figs.

6357 (INIS-mf–13025 vp.) **Plutonium chemistry and fast reactor fuel reprocessing (Preprint no. IT-18).** Vasudeva Rao, P.R. (Indira Gandhi Centre for Atomic Research, Kalpakkam (India)); Srinivasan, T.G. Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. Feb 1991. 685p. (CONF-9102132–: International symposium on radiochemistry and radiation chemistry - plutonium 50, Bombay (India), 4-7 Feb 1991). In *International sympsoium on radiochemistry and radiation chemistry (Plutonium - 50 years) (held at Bombay during February 4-7, 1991): Preprints volume.* Order Number DE92001334. Source: OSTI; NTIS (US Sales Only); INIS.

Reactor fuels have conventionally been reprocessed by the Purex process, which involves the dissolution of the fuel in nitric acid followed by solvent extraction using tri-n-butylphosphate for the recovery of uranium and plutonium. The presence of large concentrations of plutonium in the process steps of fast reactor fuel reprocessing introduces a number of new considerations in design of flowsheets, that do not usually apply to thermal reactor fuel reprocessing. This paper tries to higlight some of these aspects, and also presents a brief account of the studies carried out in this area in the Radiochemistry Programme (RCP) at IGCAR. (author). 19 refs., 1 tab., 5 figs.

6358 (INIS-SU–290, pp. 106-107) **Effect of gamma-irradiation on gas evolution during thermolysis of extraction systems on the basis of TBP.** Kuprij, A.A. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Neorganicheskikh Materialov, Moscow (USSR)); Kulikov, I.A.; Vladimirova, M.V. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. 1 tab. ALKANES/radiolysis; NITRIC ACID/radiolysis; TBP/radiolysis; ALKANES; RADIOLYSIS; CHEMICAL REACTION KINETICS; GAMMA RADIATION; GASES; PYROLYSIS; QUANTITY RATIO; RADIATION DOSES; REPROCESSING; SOLUTIONS; SOLVENT EXTRACTION; TBP

6359 (JAERI-M–91-144) **Safety analysis of solvent fire accidents in a fuel reprocessing plant.** Nishio, Gunji (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Yamazaki, Noboru. Japan Atomic Energy Research Inst., Tokyo (Japan). Sep 1991. 157p. (In Japanese). Order Number DE92751027. Source: OSTI; NTIS (US Sales Only); INIS.

For analyzing the safety evaluation of solvent fire as DBA in an extraction process of nuclear fuel reprocessing plant, computer code named FACE was developed in JAERI under the auspices of the Science and Technology Agency of Japan. The code FACE can provide not only for calculations of temperature, pressure, flow rate and pressure drop in cells and ducts of the network in air-ventilation system by one- and two-dimensional analyses and smoke containing radioactive materials by burning solvent in the network but also for solvent fire behavior in the cell, transport of radioactive materials and its deposition in the network, integrity of HEPA filters, and release of radioactive materials to the environment. Calculations by FACE were compared with data obtained by large-scale demonstration tests in JAERI simulating solvent fire in the extraction process to verify mathematical modeling of the fire accident in the code. (author).

6360 (JAERI-M–91-145) **Safety demonstration tests of solvent fire accidents in a fuel reprocessing plant.** Takada, Junichi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Koike, Tadao; Tukamoto, Michio; Nishio, Gunji; Uno, Seiichiro; Kamoshida, Atsushi; Watanabe, Hironori; Hashimoto, Kazuichiro; Kitani, Susumu. Japan Atomic Energy Research Inst., Tokyo (Japan). Sep 1991. 203p. (In Japanese). Order Number DE92751028. Source: OSTI; NTIS (US Sales Only); INIS.

Demonstration tests to evaluate the safety of air-ventilation system for hypothetical solvent fire in a cell as DBA in an extraction process of nuclear fuel reprocessing plant were carried out by a large-scale fire and filter facility (FFF) in JAERI under the auspices of the Science and Technology Agency of Japan. Demonstration test data were obtained by focusing on fire behavior during solvent burning in the cell, generation of smoke containing simulant fission products from flame, transport and deposition of smoke in ducts, confinement of radioactive materials in the ventilation system and integrity of HEPA filters by using a fire and filter facility simulating a ventilation system of reference reprocessing plant in Japan. The results of the test in the present report were ready for verification of computer codes which evaluate the safety of a reprocessing plant in solvent fire accidents. (author).

6361 (PNL-SA–19681) **Batch testing of the TRUEX process on some unique Hanford wastes and of the TRUEX and SREX processes on commercial fuel reprocessing high-level waste.** Swanson, J.L.; Lumetta, G.J. Pacific Northwest Lab., Richland, WA (United States). Oct 1991. 32p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-911049–3: 7. symposium on separation science and technology for energy applications, Knoxville, TN (United States), 20-24 Oct 1991). Order Number DE92002698. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report discusses testing of the TRUEX process on Hanford wastes, and reprocessing of commercial fuel high-level wastes. The objectives of the study were to: test acid dissolution and TRUEX processing on Hanford neutralized cladding removal waste (NCRW); determine if TRUEX solvent becomes "poisoned" by Hanford complexant concentrate (CC) waste; test TRUEX on light-water reactor (LWR) fuel, PUREX high-level wastes; and test SREX on LWR fuel, PUREX and TRUEX high-level wastes. (JL)

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6362 (CONF-9110117–) **Uranium hexafluoride handling: Proceedings.** Oak Ridge National Lab., TN (United States). [1991]. 295p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. From 2. international conference on uranium hexafluoride handling; Oak Ridge, TN (United States); 29-31 Oct 1991. Order Number DE92005283. Source: OSTI; NTIS; INIS; GPO Dep.

The United States Department of Energy, Oak Ridge Field Office, and Martin Marietta Energy Systems, Inc., are co-sponsoring this Second International Conference on Uranium Hexafluoride Handling. The conference is offered as a forum for the exchange of information and concepts regarding the technical and regulatory issues and the safety aspects which relate to the handling of uranium hexafluoride. Through the papers presented here, we attempt not only to share technological advances and lessons learned, but also to demonstrate that we are concerned about the health and safety of our workers and the public, and are good stewards of the environment in which we all work and live. These proceedings are a compilation of the work of many experts in that phase of world-wide industry which comprises the nuclear fuel cycle. Their experience spans the entire range over which uranium hexafluoride is involved in the fuel cycle, from the production of UF_6 from the naturally-occurring oxide to its re-conversion to oxide for reactor fuels. The papers furnish insights into the chemical, physical, and nuclear properties of uranium hexafluoride as they influence its transport, storage, and the design and operation of plant-scale facilities for production, processing, and conversion to oxide. The papers demonstrate, in an industry often cited for its excellent safety record, continuing efforts to further improve safety in all areas of handling uranium hexafluoride.

6363 (KAERI-II/RR–28/90) **A safety study on spent fuel management: A study on the fluid-structure interaction modeling of spent fuel storage pool.** Shim, Jae Ku (Korea Atomic

Energy Research Inst., Daeduk (Korea, Republic of)); Kim, Jhin Wung; Seo, Jeong Moon; Choun, Young Sun; Kim, Dae Hong; Choi, In Gil; Hwang Shin Il. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jun 1991. 104p. (In Korean). Order Number DE92615159. Source: OSTI; NTIS (US Sales Only); INIS.

The purpose of this study is to suggest a rational method of analysis for the fluid-structure interaction of a spent fuel storage pool under earthquake loading taking into consideration of the structural responses obtained from various analysis methods and modeling techniques. A literature review, an introduction of the theory of fluid-structure interaction, a presentation of several analytical and finite element models, a comparison of the results from each model are included. For the dynamic analysis of the spent fuel storage pool three uncoupled and four coupled models are considered and response spectrum analysis method and time history analysis method are used. Based on the results of the study on various analysis models, the coupled model which utilizes the chracteristics of contact surface is concluded as the most reasonable one for the analysis of fluid-structure interaction. (Author).

6364 (NUREG–0383-Vol.3-Rev.11) **Directory of certificates of compliance for radioactive materials packages: Report of NRC approved quality assurance programs for radioactive materials packages: Volume 3, Revision 11.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Safeguards and Transportation. Oct 1991. 146p. Sponsored by Nuclear Regulatory Commission. Source: OSTI; NTIS; INIS; GPO.

This directory contains a Report of NRC Approved Packages (Volume 1), Certificates of Compliance (Volume 2), and Report of NRC Approved Quality Assurance Programs for Radioactive Materials Packages (Volume 3). The purpose of this directory is to make available a convenient source of information on Quality Assurance Programs and Packagings which have been approved by the US Nuclear Regulatory Commission. Shipments of radioactive material utilizing these packagings must be in accordance with the provisions of 49 CFR §173.471 and 10 CFR Part 71, as applicable. In satisfying the requirements of Section 71.12., it is the responsibility of the licensees to insure themselves that they have a copy of the current approval and conduct their transportation activities in accordance with an NRC approved quality assurance program.

6365 (RFP–4530) **Supercritical fluid carbon dioxide cleaning of plutonium parts.** Hale, S.J. EG and G Rocky Flats, Inc., Golden, CO (United States). Rocky Flats Plant. [1991]. 20p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC34-90DP62349. (CONF-911273–1: Solvent substitution workshop, Phoenix, AZ (United States), 12 Dec 1991). Order Number DE92004003. Source: OSTI; NTIS; GPO Dep.

Supercritical fluid carbon dioxide is under investigation in this work for use as a cleaning solvent for the final cleaning of plutonium parts. These parts must be free of organic residue to avoid corrosion in the stockpile. Initial studies on stainless steel and full-scale mock-up parts indicate that the oils of interest are easily and adequately cleaned from the metal surfaces with supercritical fluid carbon dioxide. Results from compatibility studies show that undesirable oxidation or other surface reactions are not occurring during exposure of plutonium to the supercritical fluid. Cleaning studies indicate that the oils of interest are removed from the plutonium surface under relatively mild conditions. These studies indicate that supercritical fluid carbon dioxide is a very promising cleaning medium for this application.

0510 Economic, Industrial, and Business Aspects

6366 (DOE/RW–0006-Rev.7) **Integrated Data Base for 1991: US spent fuel and radioactive waste inventories, projections, and characteristics: Revision 7.** Oak Ridge National Lab., TN (United States). Oct 1991. 310p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management; U.S. DOE Radioactive Waste Management. DOE Contract AC05-84OR21400. Source: INIS; OSTI (Free of Charge).

The Integrated Data Base (IDB) Program has compiled current data on inventories and characteristics of commercial spent fuel and both commercial and US government-owned radioactive wastes through December 31, 1990. These data are based on the most reliable information available form government sources, the open literature, technical reports, and direct contacts. The current projections of future waste and spent fuel to be generated generally through the year 2020 and characteristics of these materials are also presented. The information forecasted is consistent with the latest US Department of Energy/Energy Information Administration (DOE/EIA) projections of US commercial nuclear power growth and the expected DOE-related and private industrial and institutional (I/I) activities. The radioactive materials considered are spent fuel, high-level waste, transuranic waste, low-level waste, commercial uranium mill tailings, environmental restoration wastes, commercial reactor and fuel cycle facility decommissioning wastes, and mixed (hazardous and radioactive) low-level waste. For most of these categories, current and projected inventories are given through the year 2020, and the radioactivity and thermal power are calculated based on reported or estimated isotopic compositions. In addition, characteristics and current inventories are reported for miscellaneous radioactive materials that may require geologic disposal. 160 refs., 61 figs., 142 tabs.

0520 Waste Management

Refer also to citation(s) 6330, 6331, 6334, 6342, 6361, 6363, 6366, 6453, 6456, 6457, 6458, 6464, 6465, 6466, 6467, 6468, 6475, 6605, 6662, 6796, 6801, 6931, 6956, 7037, 7053, 7058, 7087, 7095, 7096, 7141, 7173, 7250, 7478, 7479, 7532, 7583, 7584, 7590, 7592, 7593, 7594, 7597, 7599, 7600, 7601, 7602, 7603, 7604, 7605, 7606, 7607, 7608, 7609, 7632, 7737, 8386, 8423, 8424, 8425, 8426, 8427, 8428

6367 (ANL/CP–72834) **Thermally unstable complexants: Stability of lanthanide/actinide complexes, thermal instability of the ligands, and applications in actinide separations.** Nash, K.L.; Rickert, P.G. Argonne National Lab., IL (United States). [1991]. 20p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-911049–4: 7. symposium on separation science and technology for energy applications, Knoxville, TN (United States), 20-24 Oct 1991). Order Number DE92004701. Source: OSTI; NTIS; GPO Dep.

Water soluble complexing agents are commonly used in separations to enhance the selectivity of both ion exchange and solvent extraction processes. Applications of this type in the treatment of nuclear wastes using conventional complexing agents have found mixed success due to the nature of the complexants. In addition, the residual solutions containing these species have led to potentially serious complications in waste storage. To overcome some of the limitations of carboxylic acid and aminopolycarboxylate ligands, we have initiated a program to investigate the complexing ability, thermal/oxidative instability, and separation potential of a group of water soluble organophosphorus compounds which we call Thermally Unstable Complexants, or simply TUCS. Complexants of this type appear to be superior to conventional analogues in a number of respects. In this report, we will summarize our research to date on the actinide/lanthanide complexes with a series of substituted methanediphosphonic acids, the kinetics of their oxidative decomposition, and a few applications which have been developed for their use. 17 refs., 5 figs., 3 tab.

6368 (ANL/CP–72981) **Progress in assessing the effect of ionizing radiation on the anticipated waste package environment at the Yucca Mountain potential repository site.** Reed, D.T. Argonne National Lab., IL (United States). [1991]. 11p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract W-31109-ENG-38 ;W-7405-ENG-48. (CONF-910945–6: Focus '91: nuclear waste packaging, Las Vegas, NV (United States), 29 Sep - 4 oct 1991). Order Number DE92004722. Source: OSTI; NTIS; INIS; GPO Dep.

Progress in establishing the effect of ionizing radiation on the expected air/water vapor waste package environment is summarized. This work was performed at Argonne National Laboratory (ANL) in support of the Yucca Mountain Site Characterization Project. The radiolytic issues that have been identified are presented. Long-term gamma experiments with gas compositions ranging from dry air to high-humidity air were completed. The predominant nitrogen fixation products in all air-like systems studied were nitrogen dioxide and nitric acid. Yields between 0.8 and 2.3 molec/100 eV have been measured. Ammonia formation, although not predominant, was also observed at temperature below 100°C. The ammonia yields were low, and the concentration did not build up with increased absorbed dose. The status of the issues identified is given.

6369 (BfS-ET–9/91) **ANKONA - program for computational testing of requirements of radioactive waste to be disposed in the planned final storage facility Konrad. Version as of November 1990.** Berg, H.P. (Bundesamt fuer Strahlenschutz, Braunschweig (Germany). Fachbereich Nukleare Entsorgung und Transport); Fischer, H.; Piefke, F. Bundesamt fuer Strahlenschutz, Salzgitter (Germany). May 1991. 143p. (In German). Order Number DE92750119. Source: OSTI; NTIS (US Sales Only); INIS.

Radioactive waste to be disposed of in the planned Konrad repository has to fulfil requirements which result from the analyses of the normal operation, of assumed incidents, of the termal influence of the host rock and of the critically safety. These requirements include limits of activity of groups of radionuclides and single radionuclides, which are determined by the properties of the waste packages. The program package ANKONA was developed in order to examine the requirements by means of a personal computer. Only the necessary data of the waste package, for example the waste form group and the type of waste container, have to be provided. The result of the examination is displayed on the screen and optionally printed. In case of the subprogram ANKONA, the examination is performed via dialogue, while the subprogram NUKONA automatically examines a given radionuclide vector on the basis of the provided data. This radionuclide vector can be established by the third subprogram NUKEIN. (orig.).

6370 (CONF-880839–Ses.2, pp. 36-51) **Methodology for assessing performance of waste management systems.** Meshkov, N.K. (Argonne National Lab., IL (USA)); Herzenberg, C.L.; Camasta, S.F. EG and G Idaho, Inc., Idaho Falls, ID (United States). Dec 1988. DOE Contract W-31109-ENG-38. From 10. annual Department of Energy (DOE) low-level waste management conference; Denver, CO (United States); 30 Aug - 1 sep 1988. In *Proceedings of the tenth annual DOE low-level waste management conference. Session 2: Site performance assessment.* 161p. Order Number DE89005580. Source: OSTI.

The newly revised draft DOE Order 5820.2, Chapter 3, requires that DOE low-level waste shall be managed on a systematic basis using the most appropriate combination of waste generation reduction, segregation, treatment, and disposal practices so that the radioactive components are contained and the overall cost effectiveness is minimized. This order expects each site to prepare and maintain an overall waste management systems performance assessment supporting the combination of waste management practices used in generation reduction segregation, treatment, packaging, storage, and disposal. A document prepared by EG and G Idaho, Inc. for the Department of Energy called Guidance for Conduct of Waste Management Systems Performance Assessment is specifically intended to provide the approach necessary to meet the systems performance assessment requirement of DOE Order 5820.2, Chapter 3, and other applicable state regulations dealing with LLW (low-level radioactive wastes). Methods and procedures are needed for assessing the performance of a waste management system. This report addresses this need. The purpose of the methodology provided in this report is to select the optimal way to manage particular sets of waste streams from generation to disposal in a safe and cost-effective manner, and thereby assist the DOE LLW mangers in complying with the DOE Order 5820.2, Chapter 3, and the associated guidance document.

6371 (CONF-911107–50) **Buried waste remote survey of the Idaho National Engineering Laboratory subsurface disposal area.** Richardson, B.S. (Oak Ridge National Lab., TN (United States)); Noakes, M.W.; Griebenow, B.E.; Josten, N.E. Oak Ridge National Lab., TN (United States). [1991]. 9p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC05-84OR21400. From Winter meeting of the American Nuclear Society (ANS); San Francisco, CA (United States); 10-15 Nov 1991. Order Number DE92004347. Source: OSTI; NTIS; INIS; GPO Dep.

Burial site characterization is an important first step in the restoration of subsurface disposal sites. Testing and demonstration of technology for remote buried waste site characterization were performed at the Idaho National Engineering Laboratory (INEL) by a team from five US Department of Energy (DOE) laboratories. The US Army's Soldier Robot Interface Project (SRIP) vehicle, on loan to the Oak Ridge National Laboratory (ORNL), was used as a remotely operated sensor platform. The SRIP was equipped with an array of sensors including terrain conductivity meter, magnetometer, ground-penetrating radar (GPR), organic vapor detector, gamma-based radar detector, and spectrum analyzer. The testing and demonstration were successfully completed and provided direction for future work in buried waste site characterization.

6372 (CONF-911268–1) **Approach to improved safety of high-level radioactive waste storage by the US Department of Energy.** Tseng, J.C. (USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States)); Wiffen, D.M.; Daniels, R.S. USDOE Office of Environmental Restoration and Waste Management, Washington, DC (United States). [1991]. 18p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. From CERS '91: Chinese experts radwaste symposium; Taipei (China); 17-18 Dec 1991. Order Number DE92003026. Source: OSTI; NTIS; INIS; GPO Dep.

In mid-1990 two unreviewed safety questions were identified associated with high-level radioactive wastes (HLW) storage at the US Department of Energy (DOE) Hanford Site located near Richland, Washington. Admiral Watkins, the Secretary of Energy, and Leo Duffy, the Acting Assistant Secretary for Environmental Restoration and Waste Management (EM), immediately initiated an aggressive program to resolve these two unreviewed safety questions and to improve the overall safety posture of HLW storage. This paper will first describe the DOE's approach to improve the safety of HLW storage, and then discuss DOE's program to resolve the high-priority safety issues at the Hanford Site. 3 refs.

6373 (CONF-920307–1) **Performance assessment of low-level radioactive waste disposal at Oak Ridge National Laboratory.** Lee, D.W.; Kocher, D.C. Oak Ridge National Lab., TN (United States). [1991]. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Waste management '92; Tucson, AZ (United States); 1-5 Mar 1992. Order Number DE91018172. Source: OSTI; NTIS; INIS; GPO Dep.

A draft performance assessment (PA) for continuing and future low-level radioactive waste disposal at Oak Ridge National Laboratory (ORNL) has been prepared in response to the requirements in Chapter 3 of DOE Order 5820.2A. This paper presents an overview of the draft PA and discusses the major technical and policy issues that will be addressed in preparing the final PA. The draft PA considered five different disposal technologies located at a site that has been used for low-level waste disposal since 1969. Site-specific-analyses were performed for each type of disposal unit. These included detailed consideration of (1) the waste characteristics, (2) potential releases of radionuclides from disposal units as a result of infiltrating precipitation, (3) transport of radionuclides in shallow subsurface water, groundwater, and surface water, and (4) inadvertent intrusion following loss of active institutional control.

6374 (CONF-9111105–2) **Recycling and resource recovery at Oak Ridge National Laboratory.** Hall, R.; Benson, C.E.; Grubb, R.G.; Patton, B.D. Oak Ridge National Lab., TN (United States). [1991]. 10p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC05-84OR21400. From Carribean Haztech conference; San Juan (Puerto Rico); 13-15 Nov 1991. Order Number DE92003567. Source: OSTI; NTIS; INIS; GPO Dep.

This paper discusses recycling and resource recovery strategies being developed to maintain continued operations at the Oak Ridge National Laboratory (ORNL). Several industrial decontamination techniques for minimization, segregation, and recycling of wastes volumes are presented. A wide variety of liquid wastewater streams are generated from the operations of these research facilities. The major chemical constituents – bicarbonates of calcium, magnesium, and sodium – are introduced by local river water and shallow drainage wells. Liquid low-level waste (LLLW), generated in support of DOE's nuclear energy technology programs over the past 40 years, are highly contaminated with fission products and transuranic (TRU) elements. These wastes are routinely collected in centralized collection tanks, concentrated by evaporation, and stored for future processing and disposal. The Resource Conservation and Recovery Act (RCRA) of 1976 mandated a nationwide system for the safe management of wastes that have been determined hazardous from their creation of their ultimate disposal (i.e., cradle-to-grave control). The Hazardous and Solid Waste Amendments of 1984 (HWSA) prohibited the continued placement of RCRA regulated hazardous wastes in or on the land without following Environmental Protection Agency (EPA) treatment standards. The EPA promulgated RCRA-LDR (land-disposal-restricted) regulations, minimizing short- and long-term threats arising from land disposal, will not allow facilities to store mixed LLLW after 1994 (56 FR 42730, August 29, 1991). Tank storage volume capacities are approaching maximum limits while treatment facilities to process and dispose these type wastes have been delayed indefinitely. As a result, these regulations and additional challenges have increased emphasis on recycling and resource recovery. 4 refs., 3 figs., 1 tab.

6375 (DOE/EA–0540) **Pond waste management project at the Oak Ridge, K-25 Site, Oak Ridge, Tennessee: Environmental assessment.** USDOE, Washington, DC (United States). Sep 1991. 41p. Sponsored by U.S. DOE Environment Safety & Health. Order Number DE92003906. Source: OSTI; NTIS; GPO Dep.

This report discusses the management of wastes associated with the ponds at the Oak Ridge K-25 Site. The background, proposed action, and environmental consequences of the proposed action are discussed. (JL)

6376 (DOE/ER/12812–T1) **Advanced depletion perturbation methods and waste transmutation in the IFR: Final report.** Downar, T.J. Purdue Univ., Lafayette, IN (United States). School of Nuclear Engineering. Dec 1991. 47p. Sponsored by U.S. DOE Energy Research. DOE Contract FG07-88ER12812. Order Number DE92004435. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the design of an LMR for burning minor actinides and development of advanced depletion perturbation methods. (LSP).

6377 (DOE-HMIP-RR–91.034) **Review of radioactive discharges from nuclear power stations.** Department of the Environment, London (United Kingdom). Her Majesty's Inspectorate of Pollution; Atkins (W.S.) Engineering Sciences Ltd., Warrington (United Kingdom). Feb 1991. 102p. Contract PECD-7/9/465. Order Number DE92615146. Source: OSTI; NTIS (US Sales Only); INIS.

HM Inspectorate of Pollution commissioned, with authorising responsibilities in England and Wales, a study into the discharges of radioactive effluents from Nuclear Power Stations. The study considered arisings from nuclear power stations in Europe and the USA and the technologies to treat and control the radioactive discharges. This report is a review of the arisings and concludes that suitable technologies exist, which if applied, could reduce discharges from nuclear power plants in England and Wales in line with the rest of Europe. (author).

6378 (DOE/RL/12253–T3) **Deflagration studies on waste Tank 101-SY: Test plan: Phase 1, Laboratory flammability studies of mixtures of hydrogen, nitrous oxide, and air: Revised.** Cashdollar, K.L.; Zlochower, I.A.; Hertzberg, M. Bureau of Mines, Pittsburgh, PA (United States). Pittsburgh Research Center. Jul 1991. 56p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AI06-91RL12253. Order Number DE92003489. Source: OSTI; NTIS; GPO Dep.

Waste slurries produced during the recovery of plutonium and uranium from irradiated fuel are stored in underground storage tanks. While a variety of waste types have been generated, of particular concern are the wastes stored in Tank 101-SY. A slurry growth-gas evolution cycle has been observed since 1981. The waste consists of a thick slurry, consisting of a solution high in NaOH, $NaNO_3$, $NaAlO_2$, dissolved organic complexants (EDTA, HEDTA, NTA, and degradation products), other salts (sulfates and phosphates), and radionuclides (primarily cesium and strontium). During a gas release the major gaseous species identified include: hydrogen and nitrous oxide (N_2O). Significant amounts of nitrogen may also be present. Traces of ammonia, carbon oxides, and other nitrogen oxides are also detected. Air and water vapor are also present in the tank vapor space. The purpose of the deflagration study is to determine risks of the hydrogen, nitrous oxide, nitrogen, and oxygen system. To be determined are pressure and temperature as a function of composition of reacting gases and the concentration of gases before and after the combustion event. Analyses of gases after the combustion event will be restricted to those tests that had an initial concentration of $\leq$8% hydrogen. This information will be used to evaluate safety issues related to periodic slurry growth and flammable gas releases from Tank 101-SY. the conditions to be evaluated will simulate gases in the vapor space above the salt cake as well as gases that potentially are trapped in pockets within/under the waste. The deflagration study will relate experimental laboratory results to conditions in the existing tanks.

6379 (DOE/RW–0307P-4) **Site characterization progress report: Yucca Mountain, Nevada, October 1, 1990–March 31, 1991: Number 4.** USDOE Office of Civilian Radioactive Waste Management, Washington, DC (United States). Oct 1991. 158p. Sponsored by U.S. DOE Radioactive Waste Management. Source: OSTI (Free of Charge); INIS.

In accordance with the requirements of Section 113 (b) (3) of the Nuclear Waste Policy Act of 1982, as amended (NWPA), the US Department of Energy (DOE) has prepared this report on the progress of site characterization activities at Yucca Mountain, Nevada, for the period October 1, 1990, through March 31, 1991. This report is the fourth in a series of reports that are issued at intervals of approximately six months during site characterization. The report covers a number of initiatives to improve the effectiveness of the site characterization program, and covers continued efforts related to preparatory activities, Study Plans, and performance assessment.

6380 (ECN-C–90-057) **Progress report of the ECN contribution to the experiments in the HAW project: 2nd quarter 1990.** Duijves, K.A.; Vonka, V. Netherlands Energy Research Foundation, Petten (Netherlands). Dec 1990. 17p. Contract no. F1-1W-0003-D(B). Order Number DE92613946. Source: OSTI; NTIS (US Sales Only); INIS.

This work has been performed within the framework of the Commission of the European Communities Research and Development Programme on Management and Storage of Radioactive Waste.

This progress report documents the progress of the ECN contribution in the High Active Waste experiment, a large-scale in situ test being performed underground at the Asse salt mine in Remlingen FRG, during the period April 1st through June 30th, 1990. In ch. 2 a general overview is given of the experiment development. Problems and solutions are discussed in ch. 3. (author). 4 refs.; 10 figs.

6381 (ECN-C–90-063) **Progress report of the 600 m borehole project of the CEC programme on radioactive waste management and disposal: January-July 1990.** Hamilton, L.F.M.; Jockwer, N. Netherlands Energy Research Foundation, Petten (Netherlands). Dec 1990. 24p. Contract no. FI1W/0084. Order Number DE92613948. Source: OSTI; NTIS (US Sales Only); INIS.

This work has been performed within the framework of the Commission of the European Communities Research Programme on Radioactive Waste Disposal, CEC Directorate General for Research.

In the framework of the CEC Programme on Radioactive Waste Disposal (1985-1900), in situ experiments in salt deposits are conducted. The experimental results will be used to validate analytical techniques and computer models for the prediction of salt behaviour. The experiments planned in boreholes of 600 m depth take place in the Asse II salt mine in Germany. The progress of the work during the first half of 1990 is reported. For the drilling of the boreholes a new technique has been developed. The drillings resulted in two boreholes of approximately 300 m. In one of these boreholes drilling will not continue and convergence measurements have started. The convergence measurement devices are installed in one of the holes and are successfully in operation since February 1990. Convergence data will be reported in a date report. A 2nd experiment is prepared for which the variable pressure device has been constructed. This device will be placed at the end of

1990 in the Asse salt mine after the necessary tests have been performed. A measuring program of 2 Years will be carried out during the second phase of the 600 m borehole project 1991-1992. The convergence measurement devices will be temporarily stored until a 600 m deep borehole will have been drilled at the end of 1991. (author). 7 refs.; 8 figs.

6382 (ECN-C–91-003) **Progress report of the ECN contribution to the experiments in the HAW project: 2nd half year 1990.** Duijves, K.A.; Vonka, V. Netherlands Energy Research Foundation, Petten (Netherlands). Feb 1991. 16p. Contract no. F12W-0002-C(MB). Order Number DE92613949. Source: OSTI; NTIS (US Sales Only); INIS.

This work has been performed within the framework of the Commission of the European Communities Research and Development Programme on Management and Storage of Radioactive Waste.

This progress report documents the progress of the ECN contribution in the High Active Waste experiment, a large-scale in situ test being performed underground at the Asse salt mine in Remlingen FRG, during the period July 1st through December 31st, 1990. In ch. 2 a general overview is given of the experiment development. Problems and solutions are discussed in ch. 3. (author). 3 refs.; 10 figs.

6383 (ECN-RX–91-017) **An improved model for the convergence of an excavation on rock salt: Paper to be presented at the International conference on structural mechanics in reactor technology (paper L19/5), Tokyo, Japan, August 18-23, 1991.** Prij, J. Netherlands Energy Research Foundation, Petten (Netherlands). Feb 1991. 8p. (CONF-910817–: 11. international conference on structural mechanics in reactor technology, Tokyo (Japan), 18-23 Aug 1991). Order Number DE92613952. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted for publication.

Disposal of radioactive waste in salt formations requires excavations to be made in these geological formations. When time goes by the volume of these excavations will gradually decrease. This time dependent volume change is called the convergence of the excavation and is a result of both rock salt pressure and time dependent material behaviour and consequently depends strongly on depth and temperature. Convergence is an important process through which, with the lapse of time, any leakage of ground water into the repository can be excluded. On the other hand the same convergence ensures the contaminated brine to be extruded from a mine once flooded. An accurate safety analysis therefore requires an accurate model of convergence. In the computer code ENOS, used for the nuclide transport analyses, a special model for the convergence has been incorporated, based on experiments performed in the Asse. This model is based on a reference convergence rate K_{ref} and includes multiplication factors to account for the effect of brine pressure in the borehole, changes in rock temperature and resistance of this backfill. K_{ref} is the free volumetric convergence rate of an open borehole at reference rock pressure and temperature and is assumed to be constant. In this paper it is shown that the free convergence is not a constant. An improved convergence model is proposed which accounts for a transient free convergence. The accuracy of this model is tested with finite element analysis. (author). 6 refs.; 2 figs.

6384 (EGG-WTD–9776-Rev.1) **Pad A Treatability Study long-range project plan: Revision 1.** Mousseau, J.D. EG and G Idaho, Inc., Idaho Falls, ID (United States). Aug 1991. 98p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC07-76ID01570. Order Number DE92003336. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of the Pad A Treatability Study Project is to identify and demonstrate through lab- and pilot-scale testing, technologies for treating plutonium-contaminated salt waste. This document presents proposed objectives and schedules, scope of work and breakdown structure, cost elements, deployment, benefits, and change controls for the project.

6385 (HW–55176-Pt.3) **Index of CPD crib building numbers, designs of CPD radioactive liquid waste, disposal sites: Part 3 of 7 parts, Process technology–study report.** Wood, V.W. Hanford Works, Richland, WA (United States). 21 Apr 1958. 35p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE91018783. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The purpose of this report (Part 3) is to provide a ready reference to the Redox Plant liquid waste disposal sites at the Hanford Reservation as well as a compilation of sketches showing the basic information on the design of each facility. Another objective is to establish a simplified and uniform numbering system. Still another objective is to provide an up-to-date tabulation. Subsequent parts of this report will provide information on cribs for such plants as "B" and "T" Plant. 4 refs.

6386 (IAEA-TECDOC–629) **Radioactive waste management profiles: Compilation of data from the Waste Management Data Base (WMDB).** International Atomic Energy Agency, Vienna (Austria). Oct 1991. 350p. Order Number DE92615145. Source: OSTI; NTIS (US Sales Only); INIS.

In 1989, the International Atomic Energy Agency began development of the Waste Management Data Base (WMDB) to, primarily, establish a mechanism for the collection, integration, storage, and retrieval of information relevant to radioactive waste management in Member States. This report is a summary and compilation of the information contained in the data base. The WMDB contains information and data on several aspects of waste management and offer a ready source of information on such activities as R and D efforts, waste disposal plans and programmes, important programme milestones, waste volume projections, and national and regulatory policies. This report is divided into two parts. Part one describes the Waste Management Data Base system and the type of information it contains. The second part contains data provided by Member States between August 1989 and December 1990 in response to a questionnaire sent by the Agency. However, if a Member State did not respond to the questionnaire, data from IAEA sources, such as technical assistance mission reports, were used - where such data exist. The WMDB system became operational in January 1991. The type of information contained in the data base includes radioactive waste management plans, policies and activities in Member States.

6387 (INIS-BR–2852) **Recovery of valuable products from the raffinate of uranium and thorium pilot-plant.** Martins, E.A.J. Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, SP (Brazil). 1990 125p. (In Portuguese). Order Number DE92613934. Source: OSTI; NTIS (US Sales Only); INIS.

IPEN-CNEN/SP has being very active in refining yellow cake to pure ammonium diuranate which is converted to uranium trioxide, uranium dioxide, uranium tetra-and hexa-fluoride in sequential way. The technology of the thorium purification and its conversion to nuclear grade products has been a practice since several years as well. For both elements the major waste to be worked is the raffinate from purification via TBP-varsol in pulsed columns. In this paper the actual processing technology is reviewed with special emphasis on the recovery of valuable products, mainly nitric acid, ammonium nitrate, uranium, thorium and rare earth elements. Ammonium nitrate from the precipitation of uranium diuranate is of good quality, being radioactivity and uranium-free, and recommended to be applied as fertilizer. In conclusion the main effort is to maximize the recycle and reuse of the above mentioned chemicals. (author).

6388 (INIS-BR–2866) **Concrete conditioners for low-intermediate level nuclear wastes.** Roehl, J.L. (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil)); Lorentz, R.G.; Franzen, H. Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil). [1991] 10p. Order Number DE92613956. Source: OSTI; NTIS (US Sales Only); INIS.

An effort is made to provide the disposal conditioning of low-intermediate level wastes in Brazil with concrete packages designed in such a way that, in spite of being destined to receive compacted materials in long term sub-surface disposal, they may also be able to attend other storage or disposal necessities. In this way, one develops the design of a reinforced concrete package with a net volume and interior diameter adequate to the containment of pressed 200l drums. It is believed that pressing of commercial drums is an important point for simplification and cost reduction of the overall procedure. To provide flexibility in the use of these reinforced concrete packages even in marine disposal conditions, the construction specifications follow severe prescriptions to reduce corrosion and leakage. In sequence, a study is made on the comparison of 200 l steel packages. One adapts a 25 MN capacity press for this purpose and one executes two series of tests to verify the reliable volume reduction and the final dimensions and density of the compacted elements. Conclusions are reached toward a final configuration to the reinforced concrete package and the most convenient conditions for pressing. (author).

6389 (INIS-mf-13025 vp.) **Management of radioactive wastes generated during plutonium separation and handling operations (Preprint no. IT-21).** Kumra, M.S. (Bhabha Atomic Research Centre, bombay (India). Waste Management Div.). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. Feb 1991. 685p. (CONF-9102132–: International symposium on radiochemistry and radiation chemistry - plutonium 50, Bombay (India), 4-7 Feb 1991). In *International symposium on radiochemistry and radiation chemistry (Plutonium - 50 years) (held at Bombay during February 4-7, 1991): Preprints volume.* Order Number DE92001334. Source: OSTI; NTIS (US Sales Only); INIS.

The Indian nuclear power programme, envisaged from the beginning, adopted a closed nuclear fuel cycle. This involves separation of plutonium from the spent fuel and recycling the same for nuclear power production.The recovery of plutonium from spent fuel, which is being done successfully for the past many years, along with other associated activities of fuel fabrication and relevant R and D programmes generate radioactive wastes which need to be managed in a technoeconomical and safe manner. These wastes characterised by the decay heat generation and long half lives of the radionuclides present, account for more than 99% of the radioactivity in the entire nuclear fuel cycle. Though the wastes are produced in all the three physical states, major portion appears in the liquid streams. The strategy adopted in India and status of technology development in the management of these wastes are presented in this paper. (author). 6 refs.

6390 (Juel–2450) **Transparent and conservative models to calculate the safety of radioactive waste repositories.** Memmert, G. Forschungszentrum Juelich GmbH (Germany). Inst. fuer Chemische Technologie. Feb 1991. 71p. (In German). Order Number DE92750128. Source: OSTI; NTIS (US Sales Only); INIS.

Based on new experimental results, the complicated calculation procedures to analyse the safety of repositories are rigorously simplified. These conservative calculations are sure to lead to an overestimation of radiation exposure after water ingress (flooding), but they show that the determined values are below the limit values recommended by the SSK and ICRP. For numerous fission and corrosion products as well as actinides, the concentrations for their release into the biosphere are given in tabular form - always compared with Pagis tables. The highest radiation exposures calculated by this simplified method are: (1) flooding of the Gorleben repository for LAW and MAW - 0.029 mSv/a (2.9 m rem/a) for I-129; (2) flooding of the Gorleben repository for HAW - 0.013 mSv/a (1.3 m rem/a) for Tc-99; (3) flooding of the Konrad repository - 0.011 mSv/a (1.1 m rem/a) for Ra-226. (HP).

6391 (Juel-Spez–558) **MAW and HTR-FE experimental disposal in boreholes. Study of radiation, corrosion resistance and long-term performance of instruments and electrical components under simulated in situ conditions in salt.** Niephaus, D.; Kreutz, F. Forschungszentrum Juelich GmbH (Germany). Inst. fuer Chemische Technologie der Nuklearen Entsorgung. Mar 1990. 38p. (In German). Order Number DE92750131. Source: OSTI; NTIS (US Sales Only); INIS.

The radiation experiment under simulated in situ conditions in salt has shown after about 2 years' duration that the instruments considered safety relevant (rotary potentiometer, temperature sensor) and the measuring cable for use with them (Type KKWM) will certainly withstand the maximum estimated radiation dose of approx. 1.3×10^6 Gy (1.3×10^8 rad). The dose of 6×10^6 Gy (6×10^8 rad) (sensor) or 3×10^6 Gy (3×10^8 rad) (cable) was higher by a factor of 2, and yet no failure of the components was observed. The metal jacketed heating cable used to heat the boreholes and the Type ERR power supply cable are also certainly sufficiently radiation-resistant to maintain in temperature appropriate for a final repository throughout the five years of the experiment, which is the aim of the experiment. (orig.).

6392 (KAERI-II/RR–1/90) **Evaluation of structural behavior, geological and hydrogeological characteristics: Joint roughness characteristics and shear strength.** Kim, Jhin Wung (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Rhee, Chan Goo; Hwang, Shin Il. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Feb 1991. 124p. (In Korean). Order Number DE92615158. Source: OSTI; NTIS (US Sales Only); INIS.

This study suggests a quantitative evaluation method of joint roughness coefficient (JRC). It was accomplished by using several statistical parameters to the 10 standard profiles. The results show that some of these parameters (Root mean square gradient, Structure function, and Fractal dimension) are suitable to represent the roughness characteristics. With these selected parameters, further studys have succeeded to examine the variance upon scale effect. The result shows that the fractal dimension is the most correlated parameter of all to JRC. The modified empirical equation of shear strength by introducing fractal dimension to determine JRC was suggested. To prove its validity and to examine the applicable limit of the estimated strength by this equation, the values were compared to those obtained in laboratory works. The results show that the quantification procedure for JRC permits more reliable results when the scale effect is considered. The equation which relates normal stress to shear strength of natural joints developed in gneissic rocks is also suggested. This provides inexpensive method to evaluate rock mass porperty and it can be applied to usual engineering practice. (Author).

6393 (KAERI-II/RR–15/90) **The development of radioactive waste treatment technology (III): A study on the hot off-gas treatment process.** Kim, Joon Hyung (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Yim, Sung Paal; Kim, Jeong Guk; Ahn, Byung Gil; Won, Dong Yeon; Lee, Jae Chun. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Apr 1991. 296p. (In Korean). Order Number DE92615147. Source: OSTI; NTIS (US Sales Only); INIS.

The filtration test of commercial ceramic filters was performed to obtain the basic data relating to filter manufacture development of the advanced ceramic filter and proper usage of the ceramic filter. This experiment includes pressure drop test of clean filter performance test of filter according to dust loading, observation of reverse pulsing effects and filtration cycle effects for four different kinds of commercial ceramic filters. As a result, filtration performance of the composite type filter which has a thin fiber layer on the filter surface was more excellent than that of granular bed filter. And the results could be explained by related theory. Also for the development of SiC high temperature filter media, the properties such as porosity and bulk density were measured after manufacturing the cylindrical type filter according to the grain size of silicon carbide powder, the composition of refractory binder, and the forming pressure. As the grain size of silicon carbide powder increased, porosity of filter element decreased, meanwhile, bulk density of the element increased. Composition of refractory binder did not affect the bulk density and porosity of filter element. And as the forming pressure increased, porosity of the sample decreased. In addition, stabilization of ashes has been studied. The basic physical characteristics of ashes was investigated and ashes were solidified into stable forms. A high temperature sintering method was tried to solidify the ashes. The physical characteristics of the solidified form of ashes were also observed. As a result of sintering of ashes, the ashes were changed into ceramics and the ceramic products yielded relative density around 90%, porosity up to 10%, and compressed strength in the range of from 50 to 200 MPa. (Author).

6394 (KAERI-II/RR–16/90) **The development of radioactive waste treatment technology (III): The development of solidification technology.** Kim, Hwan Young (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Kim, Ki Hong; Kang, Mun Ja; Kim, Joon Hyung. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Mar 1991. 89p. (In Korean). Order Number DE92615148. Source: OSTI; NTIS (US Sales Only); INIS.

A treatment technology to get high volume reduction is subjected to be developed for increasing a disposal capacity. A technology of drying borate waste combined with plastic solidification is found to be one of advanced methods obtaining such volume reduction. The lab-scale experiment to develop a process was already carried out, and a pilot-scale equipment was constructed. Therefore, the optimum opration condition of such process has to be obtained. In order to search the method of reduction of drying time, the properties of dried products with different water content and the supernatant were tested. Unsaturated polyester was diluted with styrene for restraining a viscosity increment in the operation of the solidification process. And the viscosity of the mixture of solidifying media with dried products and properties of their wastes forms were tested. The factors effecting the oxidative degradation of ion-exchange resin and the process factors through the foreign data were analyzed. A fundamental experiment was carried out by changing the volume of hydrogen peroxide under the desired concentration of Fe^{2+} and spent ion-exchange resins. (Author).

6395 (KAERI/RR–945/90) **Microbial treatment of aqueous wastes.** Lee, Kang Suk (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Chun, Ki Jung; Kim, Kug Chan; Choi, Yong Ho; Kim, In Gyu; Park, Hyo Kook; Kim, Jin Kyu. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1991. 49p. (In Korean). Order Number DE92615149. Source: OSTI; NTIS (US Sales Only); INIS.

Aqueous waste effluents from nuclear fuel processing operations may contain trace quantities of heavy metals such as uranium. Conventional treatment of waste waters may be ineffective or expensive when uranium concentrations in the waste water must be reduced down to I μg/ml or less. The ability of some microorganisms to uptake or adsorb dissolved heavy metals offers a promising alternative method for waste treatment. The adsorption of uranium by Rhodobacter capsulata DSM 1710 and by Rhodospirillum rubrum DSM 467, two strains of photosynthetic bacteria, was examined to identify factors that might affect processes for the removal of uranium from aqueous solution. The optimal pH of uranium biosorption was 4.5 for both strains. Temperature had little or no effect on the process since more than 95 % of dissolved uranium was adsorbed to the bacterial biomass within 10 minutes after mixing of cell biomass at 25, 30, and 40 deg C, in case of Rb. capsulata. On the other hand the uranium adsorption by Rs. rubrum was affected by temperature showing much higher activity at 40 deg C than at 25 deg C. The maximum capacity of uranium adsorption by Rb. capsulata and Rs. rubrum was 248 and 228 μg U/mg-dry biomass, respectively. Such values are the highest among the reported so far in relation to microbial biosorptive removal of uranium. Furthermore the used cells could be regenerated as reusable sorbents for several times by washing the cell-bearing uranium with sodium bicarbonate solution. In conclusion, this kind of treatment of aqueous wastes can provided a promising alternative to existing methods in that the results of our study can be applied properly to the decontamination or recovery of certain pollutants and/or valuable elements from aqueous wastes. (Author).

6396 (KEK–90-25(v.1), pp. 210-217) **The intense proton accelerator program at JAERI.** Kaneko, Yoshihiko (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

The Intense Proton Accelerator Program is a proposal to build big linear accelerator of 1.5 GeV - 10 mA class, named as 'The Engineering Test Accelerator'. The major purpose of the accelerator is to develop the technologies related to the incineration of radio-activities in the nuclear wastes from the spent fuels of nuclear power reactors. The scale of the accelerator is far large beyond those of the existing ones. Therefore, a smaller machine named as 'The Basic Technology Accelerator' will be constructed in order to bring up to technical potentials. The Intense Proton Accelerator Program is expected to widen the paths through which the nuclear energy is addressed to be clean and continually used in the future as done in the past. (author).

6397 (K/TCD–1004) **Grout-based waste forms for the solidification of anion-exchange resins: Final report.** Del Cul, G.D.; Morgan, I.L.; Bostick, W.D.; Osborne, P.E. Oak Ridge K-25 Site, TN (United States). Dec 1991. 29p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OT21400. Order Number DE92005098. Source: OSTI; NTIS; INIS; GPO Dep.

The solidification of spent ion exchange resins in a grout matrix as a means of disposing of spent organic resins produced in the nuclear fuel cycle has many advantages in terms of process simplicity and economy, but associated with the process is the potential for water/cement/resins to interact and degrade the integrity of the waste form solidified. Summarized in this document are the results of our previous investigation[1] along with new results on the encapsulation of beaded anion-exchange resins in grout formulations containing ground, granulated blast furnace slag; Type 1-2 (mixed) portland cement; and additives (clays, amorphous silica, silica fume, and fly ash). The results of the studies show that the cured waste forms tested have a low leach rate for nitrate ions from the resin, a very low leach rate for $^{99}T_c$, and acceptable durability. The results also suggest that a surrogate waste form prepared in vinyl ester styrene binder performs satisfactorily against the wetting/drying criterion, and it should offer additional insight into future work on the solidification of spent organic resins.

6398 (KURRI-TR–345, pp. 101-110) **Research on TRU annihilation treatment using accelerators.** Kanno, Ikuo (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Takada, Hiroshi; Takizuka, Takakazu; Nishida, Takahiko; Mizumoto, Motoharu; Hasegawa, Kazuo; Kaneko, Yoshihiko. Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Mar 1991. (In Japanese). (CONF-9008225–: Specialists' meeting on physics and engineering of fission and spallation; Specialists' meeting on physics and engineering of fission and spallation, Kumatori (Japan); Kumatori (Japan), 2 Aug 1990; 10 jan 1991; CONF-9101117–). In *Proceedings of the specialists' meeting on physics and engineering of fission and spallation, 1990.* 118p. Order Number DE92713857. Source: OSTI; NTIS (US Sales Only); INIS.

The transuranic elements such as Np, Am and Cm contained in the spent fuel in nuclear reactors have the long half life longer than several thousands years, and continue to emit alpha particles. The amount of transuranic elements produced in a commercial reactor of 1000 MWe in one year is shown. Also the change of toxicity of the nuclides contained in the spent fuel of commercial reactors is shown as the function of time. At present the method of solidifying high level radioactive wastes with glass and burying them in deep strata is the fundamental concept. However if the transuranic elements having long half life can be converted to the elements having short half life by some method, the burden of their final disposal can be lightened. Japan Atomic Energy Research Institute has carried out the research on the annihilation treatment of transuranic elements using a proton accelerator following the Omega Project of Science and Technology Agency. The research on the development of the proton accelerator used for annihilation treatment, the research on the nuclear and thermal examination of sub-critical system and the basic experiment on nuclear spallation are reported. (K.I.).

6399 (KURRI-TR–349) **Proceedings of the specialists' meeting on radioactive wastes management.** Higashi, Kunio (Kyoto Univ. (Japan). Faculty of Engineering); Shimoura, Kazukuni (eds.). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Apr 1991. 73p. (In Japanese). (CONF-9011260–: Specialists' meeting on radioactive wastes management, Kumatori (Japan), 13-14 Nov 1990). Order Number DE92751060. Source: OSTI; NTIS (US Sales Only); INIS.

The specialist research meeting on radioactive waste management was held in the Research Reactor Institute, Kyoto University, on November 13 and 14, 1990. This meeting has been held annually in the last several years. The meeting has taken up the topics related to both high and low level waste. This year, it was decided to place emphasis on low level waste and decommissioning waste. This report contains the proceedings of the research meeting. More than 70 persons from universities, government laboratories and private industries participated in the meeting and discussion. The lectures were given on the international trend of the disposal of low level radioactive waste, the performance evaluation test on natural barriers against the movement of radioactive nuclides in shallow underground, the environment parameters used for the calculation of dose equivalent, the construction of the high performance treatment system for fuel reprocessing waste, the present state and the technical development of nuclear facility decommissioning, and the investigation and evaluation of groundwater flow. The preparation of this proceedings was made possible by the cooperation of the authors and the assistance of Radioactive Waste Management Division of Research Reactor Institute. (K.I.).

6400 (LA–12121-MS) **Microwave fluidized-bed detoxification of hazardous waste.** Varma, R. Los Alamos National Lab., NM (United States). Nov 1991. 9p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract W-7405-ENG-36. Order Number DE92004645. Source: OSTI; NTIS; GPO Dep.

Our ongoing research and development (R&D) work focuses on demonstrating the technical feasibility of total detoxification of "C1HC" hazardous waste by using microwave energy. In addition, we investigated the capability of nahacolite for in-bed scavenging of HC1 and found it to be very effective. So far, detoxification of halocarbon vapor and liquid waste forms has been achieved. Microwave energy heats and activates the particulates of silicon carbide (SiC) and promotes chemical interactions, facilitating total detoxification of chlorinated hydrocarbons (TCEs) in an air-stream over SiC-fluidized beds under mild (<600°) conditions. The SiC promotes surface-enhanced reactions and also is a heating transfer medium. These microwave-assisted processes appear to be extremely energy efficient. The Los Alamos National Laboratory (LANL) team can demonstrate the microwave fluidized bed (MFB) technology for total detoxification of halocarbon waste streams. The technology is applicable for treatment of hazardous waste at DOE sites. 5 refs., 5 figs.

6401 (LA–12216-MS) **Design and operational parameters of transportable supercritical water oxidation waste destruction unit.** McFarland, R.D.; Brewer, G.R.; Rofer, C.K. Los Alamos National Lab., NM (United States). Dec 1991. 27p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract W-7405-ENG-36. Order Number DE92004341. Source: OSTI; NTIS; INIS; GPO Dep.

Supercritical water oxidation (SCWO) is the destruction of hazardous waste by oxidation in the presence of water at temperatures and pressures above its critical point. A 1 gal/h SCWO waste destruction unit (WDU) has been designed, built, and operated at Los Alamos National Laboratory. This unit is transportable and is intended to demonstrate the SCWO technology on wastes at Department of Energy sites. This report describes the design of the WDU and the preliminary testing phase leading to demonstration.

6402 (LA-UR–91-4035) **Natural gels in the Yucca Mountain Area, Nevada, USA.** Levy, S.S. Los Alamos National Lab., NM (United States). [1991]. 12p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract W-7405-ENG-36. (CONF-911109–5: Fall meeting of the European Materials Research Society, Strasbourg (France), 5-8 Nov 1991). Order Number DE92005058. Source: OSTI; NTIS; INIS; GPO Dep.

Relict gels at Yucca Mountain include pore- and fracture-fillings of silica and zeolite related to diagenetic and hydrothermal alternation of vitric tuffs. Water-rich free gels in fractures at Rainier Mesa consist of smectite with or without silica-rich gel fragments. Gels are being studied for their potential role in transport of radionuclides from a nuclear-waste repository.

6403 (MLM–3723(OP)) **Differences between the TERF and the ERS tritium capture systems.** Hedley, W.H.; Lamberger, P.H.; Colvin, C.M.; Gibbs, G.E.; Adams, F.S.; Bowser, R.P.; Kissner, T.J.; Morgan, F.E.; Schmidt, M.J.; Van Patten, J.F.; Wieneke, R.E. EG and G Mound Applied Technologies, Miamisburg, OH (United States). [1991]. 4p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-88DP43495. (CONF-910920–12: 4. topical meeting on tritium technology in fission, fusion, and isotopic applications, Albuquerque, NM (United States), 30 Sep - 4 oct 1991). Order Number DE92004005. Source: OSTI; NTIS; INIS; GPO Dep.

The TERF and the ERS tritium capture systems are alike in that they both use the "oxidize and dry" principle to remove tritium from gases, but they differ significantly in engineering details. The newer TERF system benefited in many ways from experience with the ERS. The TERF is expected to: (1) operate at a higher pressure, leading to greater throughput, (2) have redesigned reactors with better efficiency to process tritiated organic compounds, (3) have better energy conservation, (4) use an advanced process control system to provide more versatility in operation of the system, to account for the amount of tritium in the system at all times, and to more completely log operating results, (5) utilize more corrosion resistant materials to minimize maintenance, and (6) provide double containment of all pressurized tritium containing equipment to reduce tritium losses and increase operating safety. 6 refs.

6404 (MLM–3726(OP)) **Catalytic reactor system for the tritium emissions reduction facility.** Wieneke, R.E. EG and G Mound Applied Technologies, Miamisburg, OH (United States). [1991]. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-88DP43495. (CONF-910920–13: 4. topical meeting on tritium technology in fission, fusion, and isotopic applications, Albuquerque, NM (United States), 30 Sep - 4 oct 1991). Order Number DE92004006. Source: OSTI; NTIS; GPO Dep.

Two platinum catalyst reactor subsystems have been built for the new Tritium Emissions Reduction Facility (TERF) at Mound. The two parallel subsystems each consist of three major components: a passive conservation heat exchanger, an electric preheater, and a catalytic reactor. All subsystem components and interconnecting piping are fabricated from Inconel 625 for high temperature strength and corrosion resistance. System connections are welded for longevity and reliability. Active elements are backed up by installed spares, and the reactor catalyst is replaceable. Since double containment of tritium processing systems is an important safety concept, the entire subsystem is enclosed in a stainless steel glovebox. Careful planning during the design phase created thermal isolation from the glovebox, and the ability to translate the entire subsystem from the glovebox for major maintenance. 4 refs.

6405 (MLM–3727(OP)) **A probabilistic risk assessment of Mound's Tritium Emissions Reduction Facility (TERF).** Hedley, W.H. (EG and G Mound Applied Technologies, Miamisburg, OH (United States)); Adams, F.S.; Gibbs, G.E.; Ming, D.R.; Myers, K.J.; Wells, J.E. EG and G Mound Applied Technologies, Miamisburg, OH (United States). [1991]. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-88DP43495. (CONF-910920–11: 4. topical meeting on tritium technology in fission, fusion, and isotopic applications, Albuquerque, NM (United States), 30 Sep - 4 oct 1991). Order Number DE92004012. Source: OSTI; NTIS; INIS; GPO Dep.

A probabilistic risk assessment was made on the TERF process in order to establish its expected degree of reliability and to locate places in the system which could be improved by revision of the equipment or the operating procedures. The equipment design of the TERF was evaluated using a fault tree study. The probability of human failures was then evaluated by adding their probabilistic effects to the fault tree and then reevaluating it. It was found that (1) the TERF system is expected to be very reliable, with an annual expected downtime of only 2.35 hours, (2) the expected downtime comes almost entirely from process equipment failure rather than human errors, and (3) that certain equipment changes could be made that increased the system reliability. These equipment changes included: (1) making provision for blocking off certain automatic control values with more reliable manual valves to facilitate their repair and (2) making the two sources of power to the TERF totally independent of each other. 6 refs.

6406 (MLM–3728(OP)) **Moisture monitors for the Tritium Emissions Reduction Facility.** Hedley, W.H.; Gault, D.J.; Mielke, R.L. EG and G Mound Applied Technologies, Miamisburg, OH (United States). [1991]. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-88DP43495. (CONF-910920–10: 4. topical meeting on tritium technology in fission, fusion, and isotopic applications, Albuquerque, NM (United States), 30 Sep - 4 oct 1991). Order Number DE92004004. Source: OSTI; NTIS; GPO Dep.

Three types of moisture monitors: MCM Model Dewluxe-20, Panametrics Model System One, and Shaw Model SHA-TRS were tested for accuracy and speed of response over low (10–50 ppm H_2O), medium (100–500 ppm H_2O), and high (500–4000 ppm H_2O) concentration ranges. The results for the three instruments tested (one of each kind) showed that the MCM instrument was generally more accurate and responded more quickly than the other two instruments, with the Panametrics instrument being less accurate (except at low concentration) and slower to respond, and the Shaw instrument was the least accurate and least responsive of the three instruments during the tests made.

6407 (MLM–3729(OP)) **A distributed process control system for the Tritium Emissions Reduction Facility.** Kissner, T.J.; Wieneke, R.E. EG and G Mound Applied Technologies, Miamisburg, OH (United States). [1991]. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-88DP43495. (CONF-910920–14: 4. topical meeting on tritium technology in fission, fusion, and isotopic applications, Albuquerque, NM (United States), 30 Sep - 4 oct 1991). Order Number DE92004010. Source: OSTI; NTIS; INIS; GPO Dep.

The Tritium Emissions Reduction Facility (TERF) is an automated process that continuously removes tritium from process gases before they are discharged to the atmosphere. Key control parameters include: temperature, pressure, flow, oxygen content, total combustibles, moisture concentrations and tritium concentrations. The procurement of an industrial, microprocessor-based Distributed Process Control System was justified for TERF due to the critical nature and complexity of the system. A detailed performance specification was prepared and submitted to industrial companies who had demonstrated past success in the field of process control and instrumentation. The contract was awarded to the Foxboro Company, of Foxboro, Ma., who developed the new Intelligent Automation (I/A) Distributed Process Control System. A primary goal of the design team was that the control system increase TERF reliability and availability by automatically controlling system operation and by assisting the operator in the diagnosis of problems, preventative maintenance, alarming, report generation, and long term storage of data. The comprehensive continuous monitoring of the TERF process provided by the Foxboro I/A Distributed System is expected to: (1) optimize the system operating parameters and control the process better than was previously possible, (2) provide more alerts and alarms to aid operators in diagnosing and responding to problems, and (3) record and organize process data more effectively than before.

6408 (NKS–91-1) **The Nordic program for nuclear safety 1990-1993: Annual report 1990.** Nordisk Kontaktorgan for Atomenergispoergsmaal, Roskilde (Denmark). Feb 1991. 56p. (In Danish, Swedish, Norwegian Order Number DE92614970. Source: OSTI; NTIS (US Sales Only); INIS.

The status of ongoing projects under The Nordic Program for Nuclear Safety (NKS) 1990-1993, and the economy of the programme is presented. A review of projects, projects managers and coordinators, and a list of members of NKS and associated members is included. (CLS).

6409 (NUREG/CR–5352-Rev.1) **VAM2D: Variably saturated analysis model in two dimensions: Version 5.2 with hysteresis and chained decay transport: Documentation and user's guide: Revision 1.** Huyakorn, P.S. (HydroGeoLogic, Inc., Herndon, VA (United States)); Kool, J.B.; Wu, Y.S. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; HydroGeoLogic, Inc., Herndon, VA (United States). Oct 1991. 270p. Sponsored by Nuclear Regulatory Commission. Source: OSTI; NTIS; INIS; GPO.

This report documents a two-dimensional finite element model, VAM2D, developed to simulate water flow and solute transport in variably saturated porous media. Both flow and transport simulation can be handled concurrently or sequentially. The formulation of the governing equations and the numerical procedures used in the code are presented. The flow equation is approximated using the Galerkin finite element method. Nonlinear soil moisture characteristics and atmospheric boundary conditions (e.g., infiltration, evaporation and seepage face), are treated using Picard and Newton-Raphson iterations. Hysteresis effects and anisotropy in the unsaturated hydraulic conductivity can be taken into account if needed. The contaminant transport simulation can account for advection, hydrodynamic dispersion, linear equilibrium sorption, and first-order degradation. Transport of a single component or a multicomponent decay chain can be handled. The transport equation is approximated using an upstream weighted residual method. Several test problems are presented to verify the code and demonstrate its utility. These problems range from simple one-dimensional to complex two-dimensional and axisymmetric problems. This document has been produced as a user's manual. It contains detailed information on the code structure along with instructions for input data preparation and sample input and printed output for selected test problems. Also included are instructions for job set up and restarting procedures. 44 refs., 54 figs., 24 tabs.

6410 (NUREG/CR–5795) **Validation and testing of the VAM2D computer code.** Kool, J.B. (HydroGeoLogic, Inc., Herndon, VA (United States)); Wu, Y.S. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; HydroGeoLogic, Inc., Herndon, VA (United States). Oct 1991. 115p. Sponsored by Nuclear Regulatory Commission. Source: OSTI; NTIS; INIS; GPO.

This document describes two modeling studies conducted by HydroGeoLogic, Inc. for the US NRC under contract no. NRC-04089-090, entitled, "Validation and Testing of the VAM2D Computer Code." VAM2D is a two-dimensional, variably saturated flow and transport code, with applications for performance assessment of nuclear waste disposal. The computer code itself is documented in a separate NUREG document (NUREG/CR-5352, 1989). The studies presented in this report involve application of the VAM2D code to two diverse subsurface modeling problems. The first one involves modeling of infiltration and redistribution of water and solutes in an initially dry, heterogeneous field soil. This application involves detailed modeling over a relatively short, 9-month time period. The second problem pertains to the application of VAM2D to the modeling of a waste disposal facility in a fractured clay, over much larger space and time scales and with particular emphasis on the applicability and reliability of using equivalent porous medium approach for simulating flow and transport in fractured geologic media. Reflecting the separate and distinct nature of the two problems studied, this report is organized in two separate parts. 61 refs., 31 figs., 9 tabs.

6411 (ORNL/ER–36) **SWSA 6 interim corrective measures environmental monitoring: FY 1990 results: Environmental Restoration Program.** Ashwood, T.L.; Spalding, B.P. Oak Ridge National Lab., TN (United States). Jul 1991. 162p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC05-84OR21400. Order Number DE92003728. Source: OSTI; NTIS; INIS; GPO Dep.

Environmental Sciences Division Publication 3722.

This report presents the results and conclusions from a multifaceted monitoring effort associated with the high-density polyethylene caps installed in Solid Waste Storage Area (SWSA) 6 at Oak Ridge National Laboratory (ORNL) as an interim corrective measure (ICM). The caps were installed between November 1988 and June 1989 to meet Resource Conservation and Recovery Act (RCRA) requirements for closure of those areas of SWSA 6 that had received RCRA-regulated wastes after November 1980. Three separate activities were undertaken to evaluate the performance of the caps: (1) wells were installed in trenches to be covered by the caps, and water levels in these intratrench wells were monitored periodically; (2) samples were taken of the leachate in the intratrench wells and were analyzed for a broad range of radiological and chemical contaminants; and (3) water levels in wells outside the trenches were monitored periodically. With the exception of the trench leachate sampling, each of these activities spanned the preconstruction, construction, and postconstruction periods. Findings of this study have important implications for the ongoing remedial investigation in SWSA 6 and for the design of other ICMs. 51 figs., 2 tabs.

6412 (ORNL/M–1327) **Active Sites Environmental Monitoring Program: FY 1990 annual report.** Wickliff, D.S.; Morrissey, C.M.; Ashwood, T.L. Oak Ridge National Lab., TN (United States). Oct 1991. 53p. Sponsored by U.S. DOE Office of Environmental

Restoration and Waste Management. DOE Contract AC05-84OR21400. Order Number DE92004901. Source: OSTI; NTIS; INIS; GPO Dep.

Chapter 3 of US Department of Energy (DOE) Order 5820.2A (DOE 1988) sets forth requirements for environmental monitoring of active low-level waste (LLW) disposal sites. Active sites are defined as those LLW facilities that were in use on or after the date of the order (September 1988). The transuranic (TRU) waste storage areas in Solid Waste Storage Area (SWSA) 5 North are covered by Chap. 2 of the order. In both chapters, monitoring is required to provide for early warning of leaks before those leaks pose a threat to human health or the environment. Chapter 3 also requires that monitoring be conducted to evaluate the short- and long-term performance of LLW disposal facilities. In accordance with this order, the Solid Waste Operations Department at Oak Ridge National Laboratory (ORNL) has established an Active Sites Environmental Monitoring Program (ASEMP) that is implemented by staff of the Environmental Sciences Division (ESD) at ORNL. This report summarizes data from ASEMP monitoring activities for the final 6 months of FY 1990. A brief summary of the monitoring methodology for each site is presented also.

6413 (ORNL/M–1442) **Active Sites Environmental Monitoring Program: Mid-FY 1991 report.** Ashwood, T.L.; Wickliff, D.S.; Morrissey, C.M. Oak Ridge National Lab., TN (United States). Oct 1991. 68p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC05-84OR21400. Order Number DE92004903. Source: OSTI; NTIS; GPO Dep.

Environmental Sciences Division Publication No. 3700.

This report summarizes the activities of the Active Sites Environmental Monitoring Program (ASEMP) from October 1990 through March 1991. The ASEMP was established in 1989 by Solid Waste Operations and the Environmental Sciences Division to provide early detection and performance monitoring at active low-level radioactive waste (LLW) disposal sites in Solid Waste Storage Area (SWSA) 6 and transuranic (TRU) waste storage sites in SWSA 5 as required by chapters II and III of US Department of Energy Order 5820.2A. Monitoring results continue to demonstrate the no LLW is being leached from the storage vaults on the tumulus pads. Loading of vaults on Tumulus II began during this reporting period and 115 vaults had been loaded by the end of March 1991.

6414 (ORNL/TM–11798) **Development studies for the treatment of ORNL low-level liquid waste.** Campbell, D.O.; Lee, D.D.; Dillow, T.A. Oak Ridge National Lab., TN (United States). Nov 1991. 47p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC05-84OR21400. Order Number DE92004597. Source: OSTI; NTIS; INIS; GPO Dep.

An experimental program is under way to investigate potential separation methods for application to specific problems relating to the management of low-level liquid wastes (LLLWs) at ORNL. This report summarizes experimental results that were acquired during fiscal year 1990 and have not been previously reported elsewhere. Measurements are presented for cesium and strontium removal from simulated high-salt waste compositions, using both inorganic ion- exchange sorbents and organic ion-exchange resins, and for one experiment with actual LLLW supernate solution from Melton Valley Storage Tank W-26, using inorganic sorbents. The purpose of the study was to acquire an extensive data base to support the development of flowsheets for decontamination of the LLLW currently stored at ORNL. Experimental measurements with inorganic ion exchangers focused on batch separations of cesium using several transition-metal hexacyanoferrate(2) compositions (ferrocyanides) and of strontium using titanium oxide-based sorbents. Cesium distribution coefficients in the range of 1×10^6 were generally observed with nickel and cobalt ferrocyanides at pH values ≤ 11, yielding DFs of about 100 with 100 ppm sorbent in a single-stage batch separation. Most organic ion-exchange resins are not very effective for cesium removal from such high salt concentrations, but a new resorcinol-based resin developed at the Savannah River Site was found to be considerably superior to any other such material tested. Several chelating resins were effective for removing strontium from the waste simulants. An ion-exchange column test successfully demonstrated the simultaneous removal of both cesium and strontium from a waste simulant solution.

6415 (ORNL/TM–11891) **Low-level liquid waste decontamination by ion exchange.** Campbell, D.O.; Lee, D.D.; Dillow, T.A. Oak Ridge National Lab., TN (United States). Dec 1991. 25p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC05-84OR21400. Order Number DE92004885. Source: OSTI; NTIS; INIS; GPO Dep.

Improved processes are being developed to treat contaminated liquid wastes that have been and continue to be generated at Oak Ridge National Laboratory. Both inorganic and organic ion-exchange methods have given promising results. Nickel and cobalt hexacyanoferrate(2) compounds are extremely selective for cesium removal, with distribution coefficients in excess of 10^6 and remarkable insensitivity to competition from sodium and potassium. They tend to lose effectiveness at pH $> \sim 11$, but some formulations are useful for limited periods of time up to pH ~ 13. Sodium titanate is selective for strontium removal at high pH. The separations are so efficient that simple batch processes can yield large decontamination factors while generating small volumes of solid waste. A resorcinol-based resin developed at the Savannah River Site gave superior cesium removal, compared with other organic ion exchangers; the distribution coefficient was limited primarily by competition from potassium and was nearly independent of sodium. The optimum pH was ~ 12.5. It was much less effective for strontium removal, which was limited by competition from sodium. 8 refs., 6 figs., 9 tabs.

6416 **Process for the recovery of strontium from acid solutions.** Horwitz, E.P.; Dietz, M.L. To Dept. of Energy. 1990. Filed date 9 Apr 1990. USA Patent patent application 7-506,125. 28p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. Order Number DE92003841. Source: OSTI; NTIS; GPO Dep.

The invention is a process for selectively extracting strontium and technetium values from aqueous nitric acid waste solutions containing these and other fission product values. The extractant is a macrocyclic polyether in a diluent which is insoluble in water, but which will itself dissolve a small amount of water. The process will extract strontium and technetium values from nitric acid solutions which are up to 6 molar in nitric acid.

6417 (PNL–7822) **A summary of available information on ferrocyanide tank wastes: Hanford Tank Safety Project.** Burger, L.L. (Pacific Northwest Lab., Richland, WA (United States)); Strachan, D.M.; Reynolds, D.A.; Schulz, W.W. Pacific Northwest Lab., Richland, WA (United States). Oct 1991. 42p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract AC06-76RL01830. Order Number DE92002216. Source: OSTI; NTIS; INIS; GPO Dep.

Ferrocyanide wastes were generated at the Hanford site during the mid to late 1950s to make more tank space available for the storage of high level nuclear waste. The ferrocyanide process was developed as a method of removing ^{137}Cs from existing waste solutions and from process solutions that resulted from the recovery of valuable uranium in waste tanks. During the coarse of the research associated with the ferrocyanide process, it was discovered that ferrocyanide materials when mixed with $NaNO_3$ and/or $NaNO_2$ exploded. This chemical reactivity became an issue in the 1980s when the safety associated with the storage of ferrocyanide wastes in Hanford tanks became prominent. These safety issues heightened in the late 1980s and led to the current scrutiny of the safety associated with these wastes and the current research and waste management programs. Over the past three years, numerous explosive test have been carried out using milligram quantities of cyanide compounds. These tests provide information on the nature of possible tank reactions. On heating a mixture of ferrocyanide and nitrate or nitrite, an explosive reaction normally begins at about 240°C, but may occur well below 200°C in the presence of catalysts or organic compounds that may act as initiators. The energy released is highly dependent on the course of the reaction. Three attempts to model hot spots in local areas of the tanks indicate a very low probability of having a hot spot large enough and hot enough to be of concern. The main purpose of this document is to inform the members of the Tank Waste Science Panel of the background and issues associated with the ferrocyanide wastes. Hopefully, this document fulfills similar needs outside of the framework of the Tank Waste Science Panel. 50 refs., 9 figs., 7 tabs.

6418 (PNL–7857) **Assessment of end of life disposal, tritium recovery and purification strategies for radioluminescent lights.** Jensen, G.A. (Pacific Northwest Lab., Richland, WA (United States)); Hazelton, R.F.; Ellefson, R.E.; Carden, H.S. Pacific Northwest Lab., Richland, WA (United States). Oct 1991. 44p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE92003901. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this joint assessment by the Pacific Northwest Laboratory and EG&G Mound Applied Technologies is to identify and examine options for disposal of aged-out RL lights based on current technology, and for the possible recovery and purification of tritium from the lights and disposal of the resulting contaminated remnants. The focus of the assessment is on the waste disposal and tritium recycling issues that will evolve with use of advanced RL lighting technology and that are relevant to industrial suppliers and to civilian, military, and other government users. The scope of work also includes identification of the potential financial benefits and risks of recycle versus direct disposal. 5 refs., 8 figs., 13 tabs.

6419 (PNL-SA–19867) **Effects of an oxidizing atmosphere in a spent fuel packaging facility.** Einziger, R.E. Pacific Northwest Lab., Richland, WA (United States). Sep 1991. 36p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-76RL01830. (CONF-910945–2: Focus '91: nuclear waste packaging, Las Vegas, NV (United States), 29 Sep - 4 oct 1991). Order Number DE92002158. Source: OSTI; NTIS; INIS; GPO Dep.

Sufficient oxidation of spent fuel can cause a cladding breach to propagate, resulting in dispersion of fuel particulates and gaseous radionuclides. The literature for spent fuel oxidation in storage and disposal programs was reviewed to evaluate the effect of an oxidizing atmosphere in a preclosure packaging facility on (1) physical condition of the fuel and (2) operations in the facility. Effects such as cladding breach propagation, cladding oxidation, rod dilation, fuel dispersal, ^{14}C and ^{85}Kr release, and crud release were evaluated. The impact of these effects, due to oxidation, upon a spent fuel handling facility is generally predicted to be less than the impact of similar effects due to fuel rod breached during handling in an inert-atmosphere facility. Preliminary temperature limits of 240°C and 227°C for a 2-week or 4-week handling period and 175°C for 2-year lag storage would prevent breach propagation and fuel dispersal. Additional data that are needed to support the assumptions in this analysis or complete the database were identified.

6420 (PNL-SA–20045) **Conceptual adsorption models and open issues pertaining to performance assessment.** Serne, R.J. Pacific Northwest Lab., Richland, WA (United States). Oct 1991. 49p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-76RL01830. (CONF-9110246–2: Nuclear energy agency sorption workshop '91, Interlaken, (Switzerland), 14-22 Oct 1991). Order Number DE92002741. Source: OSTI; NTIS; INIS; GPO Dep.

Recently several articles have been published that question the appropriateness of the distribution coefficient, Rd, concept to quantify radionuclide migration. Several distinct issues are raised by various critics. In this paper I provide some perspective on issues surrounding the modeling of nuclide retardation. The first section defines adsorption terminology and discusses various adsorption processes. The next section describes five commonly used adsorption conceptual models, specifically emphasizing what attributes that affect adsorption are explicitly accommodated in each model. I also review efforts to incorporate each adsorption model into performance assessment transport computer codes. The five adsorption conceptual models are (1) the constant Rd model, (2) the parametric Rd model, (3) isotherm adsorption models, (4) mass-action adsorption models, and (5) surface-complexation with electrostatics models. The final section discusses the adequacy of the distribution ratio concept, the adequacy of transport calculations that rely on constant retardation factors and the status of incorporating sophisticated adsorption models into transport codes.

6421 (RFP–4479) **Removal of actinides from Rocky Flats soil.** Kochen, R.L.; McGlochin, S.C.; Pettis, S.A. EG and G Rocky Flats, Inc., Golden, CO (United States). Rocky Flats Plant. 12 Sep 1991. 20p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC34-90DP62349. Order Number DE92004800. Source: OSTI; NTIS; GPO Dep.

A study was performed to evaluate a gravimetric separator (mineral jig) in conjunction with wet sieving for removing actinide-containing clays from Rocky Flats soil. Both field-moist (3% moisture) and pre-dried (110°C) soils were wet sieved and mineral jigged. In addition, size separation (dry sieving), attrition scrubbing, and rotary scrubbing were evaluated for actinide removal in field-moist soil. Wet sieving removed >98% of the activity in both field-moist and pre-dried, <50- to 4.0-mm soil fractions. More than 99% of the activity was removed from soil that was first size separated (<50 to 4.0 mm) and then wet sieved. Actinide removal in the <4.0- to 2.4-mm and <2.4- to 0.42-mm soil fractions followed the sequence: attrition scrubbing > wet sieving > rotary scrubbing. Wet sieving removed about 20% more activity from field-moist, <4.0- to 2.4-mm soil fractions compared to similar, pre-dried soil fractions. The mineral jig removed actinide-containing clays from the <0.42-mm soil fractions. The americium was lowered from 100 to 11 pCi/g in 4 wt % of the soil (<0.42 to 0.250 mm). Sodium hydroxide solution (pH 12.5) was used in all of the wet soil decontamination procedures. The spent NaOH wash solutions were filtered (2.5 μm) and the total alpha activity in the filtered solutions was <1 pCi/mℓ.

6422 (SAND–87-2777) **Retrieval strategy report for a potential high-level nuclear waste repository: Yucca Mountain Site Characterizadtion Project.** Flores, R. Sandia National Labs., Albuquerque, NM (United States). Dec 1991. 521p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC04-76DP00789. Order Number DE92005385. Source: OSTI; NTIS; INIS; GPO Dep.

In federal laws, regulations, and departmental directives, the US Congress, the Nuclear Regulatory Commission, and the US Department of Energy have developed criteria for retrievability of waste emplaced in a geologic repository for high-level radioactive waste. In response to these criteria, the Yucca Mountain Project has included in the design of the potential repository at Yucca Mountain the option to retrieve emplaced waste as a planned contingency operation. This report presents a Project strategy for maintaining retrievability. It includes descriptions of repository and equipment designs; the operations during waste emplacement, post-emplacement, and retrieval; and expected repository conditions (normal and abnormal). Retrieval-related regulations and requirements are presented and discussed as a basis for evaluating the designs and operations plans. The report concludes with discussions of retrieval strategy implementation, which includes determining which equipment and operations demonstrations are necessary or required and plans for future work. 78 figs., 34 tabs.

6423 (SAND–88-3164) **Calculation of experiment uncertainty in laboratory determination of several geoengineering properties of tuffs from Yucca Mountain, Nevada: Yucca Mountain Site Characterization Project.** Nimick, F.B.; Schwartz, B.M.; Price, R.H. Sandia National Labs., Albuquerque, NM (United States). Nov 1991. 39p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC04-76DP00789. Order Number DE92003612. Source: OSTI; NTIS; INIS; GPO Dep.

A method for estimating the precision and accuracy of measured parameters is described. Examples of application of the estimating method are presented for density, porosity, compressive strength, Young's modulus, Poisson's ratio, and thermal expansion. With the exception of the coefficient of linear thermal expansion, all laboratory data for these properties for tuff samples appear to have reasonable experiment uncertainties. Uncertainties in the thermal-expansion coefficients may be as high as 39% of the values, although most uncertainties for the coefficients are probably ≤2%. 4 refs., 1 fig., 15 tabs.

6424 (SAND–88-7065) **Documentation and verification of the SHAFT code: Yucca Mountain Site Characterization Project.** St.John, C.M. (Agapito (J.F.T.) and Associates, Inc., Grand Junction, CO (United States)). Sandia National Labs., Albuquerque, NM (United States); Agapito (J.F.T.) and Associates, Inc., Grand Junction, CO (United States). Dec 1991. 173p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC04-76DP00789. Order Number DE92004786. Source: OSTI; NTIS; INIS; GPO Dep.

The SHAFT code incorporates equations to compute stresses in a shaft liner when the rock through which a shaft passes is subject to known three-dimensional states of stress or strain. The deformation modes considered are hoop deformation, axial deformation, and shear on a plane normal to the shaft axis. Interaction between the liner and the soil and rock is considered, and it is assumed that the liner is in place before loading is applied. This code is intended to be used interactively but creates a permanent record complete with necessary quality assurance information. The code has been carefully verified for the case of generalized plane strain, in which an arbitrary axial strain can be defined. It may also be used for plane stress analysis. Output is given in the form of stresses at selected sample points in the linear and the rock and a simple graphical representation of the distribution of stress through the liner. 12 figs., 13 tabs.

6425 (SAND–89-0837) **Drift design methodology and preliminary application for the Yucca Mountain Site Characterization Project: Yucca Mountain Site Characterization Project.** Hardy, M.P. (Agapito (J.F.T.) and Associates, Inc., Grand Junction, CO (United States)); Bauer, S.J. Sandia National Labs., Albuquerque, NM (United States). Dec 1991. 168p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC04-76DP00789. Order Number DE92004788. Source: OSTI; NTIS; INIS; GPO Dep.

Excavation stability in an underground nuclear waste repository is required during construction, emplacement, retrieval (if required), and closure phases to ensure worker health and safety, and to prevent development of potential pathways for radionuclide migration in the post-closure period. Stable excavations are developed by appropriate excavation procedures, design of the room shape, design and installation of rock support reinforcement systems, and implementation of appropriate monitoring and maintenance programs. In addition to the loads imposed by the in situ stress field, the repository drifts will be impacted by thermal loads developed after waste emplacement and, periodically, by seismic loads from naturally occurring earthquakes and underground nuclear events. A priori evaluation of stability is required for design of the ground support system, to confirm that the thermal loads are reasonable, and to support the license application process. In this report, a design methodology for assessing drift stability is presented. This is based on site conditions, together with empirical and analytical methods. Analytical numerical methods are emphasized at this time because empirical data are unavailable for excavations in welded tuff either at elevated temperatures or under seismic loads. The analytical methodology incorporates analysis of rock masses that are systematically jointed, randomly jointed, and sparsely jointed. In situ thermal and seismic loads are considered. Methods of evaluating the analytical results and estimating ground support requirements for all the full range of expected ground conditions are outlines. The results of a preliminary application of the methodology using the limited available data are presented. 26 figs., 55 tabs.

6426 (SAND–89-1989) **Areal power density: A preliminary examination of underground heat transfer in a potential Yucca Mountain repository and recommendations for thermal design approaches: Yucca Mountain Site Characterization Project.** Hertel, E.S. Jr.; Ryder, E.E. Sandia National Labs., Albuquerque, NM (United States). Nov 1991. 77p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC04-76DP00789. Order Number DE92004789. Source: OSTI; NTIS; INIS; GPO Dep.

The design of the potential Yucca Mountain repository is subject to many thermal goals related to the compliance of the site with federal regulations. This report summarizes a series of sensitivity studies that determined the expected temperatures near the potential repository. These sensitivity studies were used to establish an efficient loading scheme for the spent fuel canisters and a maximum areal power density based strictly on thermal goals. Given the current knowledge of the site, a design-basis areal power density of 80 kW/acre can be justified based on thermal goals only. Further analyses to investigate the impacts of this design-basis APD on mechanical and operational aspects of the potential repository must be undertaken before a final decision is made.

6427 (SAND–89-7023) **Documentation and verification of STRES3D, Version 4.0: Yucca Mountain Site Characterization Project.** Asgian, M.I. (Agapito (J.F.T.) and Associates, Inc., Grand Junction, CO (United States)); St. John, C.M.; Hardy, M.P.; Goodrich, R.R. Sandia National Labs., Albuquerque, NM (United States); Agapito (J.F.T.) and Associates, Inc., Grand Junction, CO (United States). Dec 1991. 235p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC04-76DP00789. Order Number DE92004785. Source: OSTI; NTIS; INIS; GPO Dep.

STRES3D is a thermomechanical analysis code for predicting transient temperatures, stresses and displacements in an infinite and semi-infinite, conducting, homogeneous, elastic medium. The heat generated at the sources can be constant or decay exponentially with time. Superposition is used to integrate the effect of heat sources distributed in space and time to simulate the thermomechanical effect of placement of heat generating nuclear waste canisters in an underground repository. Heat sources can be defined by point, lines or plates with numerical integration of the kernal point source solution used to develop the line and plate sources. STRES3D is programmed using FORTRAN77 and is suitable for use on micro or larger computer systems.

6428 (SAND–90-2261) **Research program to develop and validate conceptual models for flow and transport through unsaturated, fractured rock: Yucca Mountain Site Characterization Project.** Glass, R.J.; Tidwell, V.C. Sandia National Labs., Albuquerque, NM (United States). Sep 1991. 63p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC04-76DP00789. Order Number DE92004301. Source: OSTI; NTIS; INIS; GPO Dep.

As part of the Yucca Mountain Project, our research program to develop and validate conceptual models for flow and transport through unsaturated fractured rock integrates fundamental physical experimentation with conceptual model formulation and mathematical modeling. Our research is directed toward developing and validating macroscopic, continuum-based models and supporting effective property models because of their widespread utility within the context of this project. Success relative to the development and validation of effective property models is predicted on a firm understanding of the basic physics governing flow through fractured media, specifically in the areas of unsaturated flow and transport in a single fracture and fracture-matrix interaction.

6429 (SAND–90-2748) **18 W/m^2 Mockup for Defense High-Level Waste (Rooms A): In situ data report: Volume 1—Mechanical response gages (February 1985–June 1990): Waste Isolation Pilot Plant (WIPP) Thermal/Structural Interactions Program.** Munson, D.E. (Sandia National Labs., Albuquerque, NM (United States)); Petney, S.V.; Clancy, R.M.; Ball, J.R.; Jones, R.L.; Northrop-Salazar, C.L. Sandia National Labs., Albuquerque, NM (United States). Oct 1991. 623p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE92004790. Source: OSTI; NTIS; INIS; GPO Dep.

Data are presented from the 18 W/m^2 Mockup for Defense High-Level Waste, a very large scale in situ test fielded underground at the Waste Isolation Pilot Plant (WIPP). These data include selected fielding information, test configuration, instrumentation activities, and comprehensive results from a large number of gages. The results in this report give measured data from the mechanical response gages, i.e., room closure gages, extensometers, and stress meters emplaced in the test. Construction of the test began in June 1984; gage data in this report cover the complete test duration, that is, to June 1990.

6430 (SAND–91-0269) **Changes in rock salt permeability due to nearby excavation.** Stormont, J.C. (Sandia National Labs., Albuquerque, NM (United States)); Howard, C.L.; Daemen, J.J.K. Sandia National Labs., Albuquerque, NM (United States). Jul 1991. 17p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC04-76DP00789. (CONF-910728–8: 32. US symposium on rock mechanics, Norman, OK (United States), 10-12 Jul 1991). Order Number DE92003589. Source: OSTI; NTIS; GPO Dep.

Changes in brine and gas permeability of rock salt as a result of nearby excavation (mine-by) have been measured from the underground workings of the WIPP facility. Prior to the mine-by, the formation responds as a porous medium with a very low brine permeability, a significant pore (brine) pressure and no measurable gas permeability. The mine-by excavation creates a dilated, partially saturated zone in the immediate vicinity of the excavation with an increased permeability to brine and a measurable permeability to gas. The changes in hydrologic properties are discussed in the context of pore structure changes.

6431 (SAND–91-0893/1) **Preliminary comparison with 40 CFR Part 191, Subpart B for the Waste Isolation Pilot Plant, December 1991: Volume 1: Methodology and results.** Sandia National Labs., Albuquerque, NM (United States). Dec 1991. 534p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE92005044. Source: OSTI; NTIS; INIS; GPO Dep.

Before disposing of transuranic radioactive wastes at the Waste Isolation Pilot Plant (WIPP), the United States Department of Energy must have a reasonable expectation that the WIPP will comply with the quantitative requirements of Subpart B of the United States Environmental Protection Agency's (EPA) Standard, Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes. Sandia National Laboratories, through iterative performance assessments of the WIPP disposal system, is conducting an evaluation of the long-term performance of the WIPP that includes analyses for the Containment Requirements and the Individual Protection Requirements of Subpart B of the Standard. Recognizing that unequivocal proof of compliance with the Standard is not possible because of the substantial uncertainties in predicting future human actions or natural events, the EPA expects compliance to be determined on the basis of specified quantitative analyses and informed, qualitative judgment. Performance assessments of the WIPP will provide as detailed and thorough a basis as practical for the quantitative aspects of that decision.

6432 (SAND–91-0893/2) **Preliminary comparison with 40 CFR Part 191, Subpart B for the Waste Isolation Pilot Plant: Volume 2: Probability and consequence modeling.** Sandia National Labs., Albuquerque, NM (United States). Dec 1991. 388p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC04-76DP00789. Order Number DE92004914. Source: OSTI; NTIS; INIS; GPO Dep.

This second volume documents the probability and consequence modeling done by the Performance Assessment Division of Sandia National Laboratories for the 1991 preliminary performance assessment (PA) of the Waste Isolation Pilot Plant (WIPP). The volume provides an overview of the PA calculations; discusses the mechanics of the probability modeling and construction of the complementary cumulative distribution functions (CCDFs); discusses the generic computational models and the applied (or site-specific) models used in consequence analysis and the results that these models predict for both undisturbed conditions (base case) and disturbed conditions (in which one or more hypothetical boreholes intrude the repository during the 10,000-year regulatory period); and tabulates the calculational results used to construct the CCDFs reported in Volume 1. 87 figs., 18 tabs.

6433 (SAND–91-0893/3) **Preliminary comparison with 40 CFR Part 191, Subpart B for the Waste Isolation Pilot Plant, December 1991: Volume 3: Reference data.** Rechard, R.P. (Sandia National Labs., Albuquerque, NM (United States)); Peterson, A.C.; Tierney, M.S. (eds.); Schreiber, J.D.; Sandha, J.S. (eds.). Sandia National Labs., Albuquerque, NM (United States). Dec 1991. 692p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC04-76DP00789. Order Number DE92004981. Source: OSTI; NTIS; INIS; GPO Dep.

This volume documents the data available as of August 1991, which were used by the Performance Assessment Division of Sandia National Laboratories in its 1991 preliminary performance assessment of the Waste Isolation Pilot Plant (WIPP). Ranges and distributions for about 300 modeling parameters, several of which are spatially varying parameters with between 15 and 80 point values, and about 500 well locations and corresponding stratigraphic elevations are presented in both tables and graphics for the geologic and engineered barriers, global materials (e.g., fluid properties), and agents that act upon the WIPP disposal system such as climate variability and human-intrusion boreholes. Sources for the data and a brief discussion of each parameter are also provided.

6434 (SAND–91-1827C) **Treatment of uncertainty in low-level waste performance assessment.** Kozak, M.W.; Olague, N.E.; Gallegos, D.P.; Rao, R.R. Sandia National Labs., Albuquerque, NM (United States). [1991]. 12p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC04-76DP00789. (CONF-911114–1: 13. annual DOE low-level waste management conference, Atlanta, GA (United States), 19-21 Nov 1991). Order Number DE92003297. Source: OSTI; NTIS; INIS; GPO Dep.

Uncertainties arise from a number of different sources in low-level waste performance assessment. In this paper the types of uncertainty are reviewed, and existing methods for quantifying and reducing each type of uncertainty are discussed. These approaches are examined in the context of the current low-level radioactive waste regulatory performance objectives, which are deterministic. The types of uncertainty discussed in this paper are model uncertainty, uncertainty about future conditions, and parameter uncertainty. The advantages and disadvantages of available methods for addressing uncertainty in low-level waste performance assessment are presented. 25 refs.

6435 (SAND–91-2099C) **The use of expert elicitation to quantify uncertainty in incomplete sorption data bases for Waste Isolation Pilot Plant performance assessment.** Anderson, D.R. (Sandia National Labs., Albuquerque, NM (United States)); Trauth, K.M.; Hora, S.C. Sandia National Labs., Albuquerque, NM (United States). [1991]. 29p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC04-76DP00789. (CONF-9110246–1: Nuclear energy agency sorption workshop '91, Interlaken, (Switzerland), 14-22 Oct 1991). Order Number DE92002013. Source: OSTI; NTIS; INIS; GPO Dep.

Iterative, annual performance-assessment calculations are being performed for the Waste Isolation Pilot Plant (WIPP), a planned underground repository in southeastern New Mexico, USA for the disposal of transuranic waste. The performance-assessment calculations estimate the long-term radionuclide releases from the disposal system to the accessible environment. Because direct experimental data in some areas are presently of insufficient quantity to form the basis for the required distributions. Expert judgment was used to estimate the concentrations of specific radionuclides in a brine exiting a repository room or drift as it migrates up an intruding borehole, and also the distribution coefficients that describe the retardation of radionuclides in the overlying Culebra Dolomite. The variables representing these concentrations and coefficients have been shown by 1990 sensitivity analyses to be among the set of parameters making the greatest contribution to the uncertainty in WIPP performance-assessment predictions. Utilizing available information, the experts (one expert panel addressed concentrations and a second panel addressed retardation) developed an understanding of the problem and were formally elicited to obtain probability distributions that characterize the uncertainty in fixed, but unknown, quantities. The probability distributions developed by the experts are being incorporated into the 1991 performance-assessment calculations. 16 refs., 4 tabs.

6436 (SAND–91-2247C) **WIPP small scale seal performance tests: Status and impacts.** Finley, R.E.; Tillerson, J.R. Sandia National Labs., Albuquerque, NM (United States). [1991]. 11p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC04-76DP00789. (CONF-9110239–2: Solution Mining Research Institute (SMRI) semiannual meeting, Las Vegas, NV (United States), 28-29 Oct 1991). Order Number DE92003626. Source: OSTI; NTIS; INIS; GPO Dep.

Numerous small-scale in situ seal experiments have been emplaced in boreholes up to 38 in. in diameter at the WIPP. Seal materials include expansive salt concrete, bentonite, and crushed salt. Emplacement techniques stressed conventional technology and the use of available site personnel. Preliminary evaluation of the performance of these seals has been completed by using structural data from embedded instrumentation and fluid flow data from gas and brine flow measurements. Preliminary results suggest that submicrodarcy permeabilities can be obtained using these materials and that structural performance is satisfactory. 17 refs., 3 figs., 1 tab.

6437 (SKB-TR-91-35) **Storage of nuclear waste in long boreholes.** Sandstedt, H. (Tyrens, Sundbyberg (Sweden)); Wichmann, C.; Pusch, R.; Boergesson, L.; Loennerberg, B. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Aug 1991. 115p. Order Number DE92613959. Source: OSTI; NTIS (US Sales Only); INIS.

This report constitutes a feasibility study for the storage of high level radioactive waste in long TBM drilled tunnels. The report will form the basis for a comparison with other concepts in future analysis of the isolation performance in a typical Swedish rock structure. The suggested repository concept consists of three parallel, 4.5 km long, horizontal tunnels at a depth of 500 m constructed using TBM technology. The tunnel diameter will be about 2.4 m for deployment of canisters with a diameter of 1.6 m. The space between the canisters and rock will be totally sealed off by bentonite. The study comprises the design of canisters, canister handling and deposition, near field design, near field sealing and behaviour, and technical design of the repository. The report also includes a tentative time schedule and cost estimate, incorporating the construction phase and deployment of canisters. (au).

6438 (UCID-21414-Rev.1) **Thermal performance of a buried nuclear waste storage container storing a hybrid mix of PWR and BWR spent fuel rods: Revision 1.** Johnson, G.L. Lawrence Livermore National Lab., CA (United States). Nov 1991. 105p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract W-7405-ENG-48. Order Number DE92004466. Source: OSTI; NTIS; INIS; GPO Dep.

Lawrence Livermore National Laboratory will design, model, and test nuclear waste packages for use at the Nevada Nuclear Waste Storage Repository at Yucca Mountain, Nevada. On such package would store tightly packed spent fuel rods from both pressurized and boiling water reactors. The storage container provides the primary containment of the nuclear waste and the spent fuel rod cladding provides secondary containment. A series of transient conduction and radiation heat transfer analyses was run to determine for the first 1000 yr of storage if the temperature of the tuff at the borehole wall ever falls below 97°C and whether the cladding of the stored spent fuel ever exceeds 350°C. Limiting the borehole to temperatures of 97°C or greater helps minimize corrosion by assuring that no condensed water collects on the container. The 350°C cladding limit minimizes the possibility of creep- related failure in the spent fuel rod cladding. For a series of packages stored in a 8 x 30 m borehole grid where each package contains 10-yr-old spent fuel rods generating 4.74 kW or more, the borehole wall stays above 97°C for the full 10000-yr analysis period. For the 4.74-kW load, the peak cladding temperature rises to just below the 350°C limit about 4 years after emplacement. If the packages are stored using the spacing specified in the Site Characterization Plan (15 ft x 126 ft), a maximum of 4.1 kW per container may be stored. If the 0.05-m-thick void between the container and the borehole wall is filled with loosely packed bentonite, the peak cladding temperature rises more than 40°C above the allowed cladding limit. In all cases the dominant heat transfer mode between container components is thermal radiation.

6439 (UCRL-ID-108153) **Physical limits on steam generation by radioactive decay heat.** Chesnut, D.A. Lawrence Livermore National Lab., CA (United States). Dec 1991. 7p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract W-7405-ENG-48. Order Number DE92004468. Source: OSTI; NTIS; INIS; GPO Dep.

This report briefly discusses the possibilities that flood water contacting the hot radioactive waste and rock at Yucca Mountain could produce enough steam to lift the top of the mountain off the repository.

6440 (UCRL-JC-106759) **The impact of episodic nonequilibrium fracture-matrix flow on geological repository performance.** Buscheck, T.A.; Nitao, J.J.; Chestnut, D.A. Lawrence Livermore National Lab., CA (United States). 29 Oct 1991. 12p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract W-7405-ENG-48. (CONF-910945-5: Focus '91: nuclear waste packaging, Las Vegas, NV (United States), 29 Sep - 4 oct 1991). Order Number DE92004673. Source: OSTI; NTIS; INIS; GPO Dep.

Adequate representation of fracture-matrix interaction during episodic infiltration events is crucial in making valid hydrological predictions of repository performance at Yucca Mountain. Various approximations have been applied to represent fracture-matrix flow interaction, including the Equivalent Continuum Model (ECM), which assumes capillary equilibrium between fractures and matrix, and the Fracture-Matrix Model (FMM), which accounts for nonequilibrium fracture-matrix flow. We analyze the relative impact of matrix imbibition on episodic nonequilibrium fracture-matrix flow for the eight major hydrostratigraphic units in the unsaturated zone at Yucca Mountain. Comparisons are made between ECM and FMM predictions to determine the applicability of the ECM. The implications of nonequilibrium fracture-matrix flow on radionuclide transport are also discussed.

6441 (UCRL-JC-106916) **Engineered barrier system and waste package design concepts for a potential geologic repository at Yucca Mountain.** Short, D.W.; Ruffner, D.J.; Jardine, L.J. Lawrence Livermore National Lab., CA (United States). Oct 1991. 13p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract W-7405-ENG-48. (CONF-910945-4: Focus '91: nuclear waste packaging, Las Vegas, NV (United States), 29 Sep - 4 oct 1991). Order Number DE92004657. Source: OSTI; NTIS; INIS; GPO Dep.

We are using an iterative process to develop preliminary concept descriptions for the Engineered Barrier System and waste-package components for the potential geologic repository at Yucca Mountain. The process allows multiple design concepts to be developed subject to major constraints, requirements, and assumptions. Involved in the highly interactive and interdependent steps of the process are technical specialists in engineering, metallic and nonmetallic materials, chemistry, geomechanics, hydrology, and geochemistry. We have developed preliminary design concepts that satisfy both technical and nontechnical (e.g., programmatic or policy) requirements.

6442 (WHC-EP-0225-Rev.1) **Contact-handled transuranic waste characterization based on existing records: Revision 1.** Anderson, B.C.; Anderson, J.D.; Demiter, J.A.; Duncan, D.R.; Fort, L.A.; McCann, D.C.; Stone, S.J. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 171p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-87RL10930. Order Number DE92002744. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains the results of characterizing the retrievably stored, contact-handled transuranic (CH-TRU) waste based on existing records. This report is the first comprehensive analysis of these records. A history of the methods used in storing the transuranic waste and in determining how the data was accumulated for entry into the Richland-Solid Waste Information Management System (R-SWIMS) is also described. Data from the R-SWIMS have been the primary source of information in characterizing the waste contents. Supporting documents and interviews with knowledgeable people provide the basis for the documenting the history of storage practices. The storage conditions will be investigated further to ensure that a representative statistical sample is obtained for the second phase of this characterization program.

6443 (WHC-EP-0379) **Preliminary performance assessment strategy for single-shell tank waste disposal.** Sonnichsen, J.C. Jr. Westinghouse Hanford Co., Richland, WA (United States). Oct 1991. 59p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE92002912. Source: OSTI; NTIS; INIS; GPO Dep.

The disposal of the waste stored in single-shell tanks at the Hanford Site is recognized as a major environmental concern. A comprehensive program has been initiated to evaluate the various alternatives available for disposal of these wastes. Theses wastes will be disposed of in a manner consistent with applicable laws and regulations. Long-term waste isolation is one measure of performance that will be used for purposes of selection. The performance of each disposal alternative will be simulated using numerical models. Contained herein is a discussion of the strategy that has and continues to evolve to establish a general analytical framework to evaluate this performance. This general framework will be used to construct individual models of each waste disposal alternative selected for purposes of evaluation. 30 refs., 3 figs.

6444 (WHC-EP–0405-DraftA-Vol.5) **Systems engineering study for the closure of single-shell tanks: Draft A, Volume 5.** Boomer, K.D.; Boldt, A.L.; Britton, M.D.; Engelsman, L.E.; Galbraith, J.D.; Garfield, J.S.; Giese, K.A.; Golberg, C.E.; Higley, B.A.; Hull, K.J.; Johnson, L.J.; Knight, R.P.; Layman, J.S.; Marusich, R.S.; Parazin, R.J.; Piepho, M.G.; Slaathaug, E.J.; WaldoWestinghouse Hanford Co., Richland, WA (United States). Aug 1991. 502p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE92003071. Source: OSTI; NTIS; INIS; GPO Dep.

Several radioactive waste processing technologies, for the processing of Hanford single-shell tank wastes, are presented. Technologies presented include: ceramic grout processing; ceramic pellet facility; in-situ vitrification; a glass in sulfur facility; a containerized glass facility; mineral grout facility; salt polyethylene process; and the salt grout process. Interim storage facilities are also discussed. (CBS)

6445 (WHC-EP–0412) **Fate and transport of constituents leaked from Tank 241-A-105.** Caggiano, J.A. Westinghouse Hanford Co., Richland, WA (United States). Oct 1991. 102p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE92002914. Source: OSTI; NTIS; INIS; GPO Dep.

Following a January 28, 1965 sudden steam release in Tank 241-A-105, the carbon steel liner of the tank was noted to have bulged to a maximum height of about 8.5 feet (2.6 meters). Most of this bulging likely resulted from the January 28, 1965 incident. But available data indicate that some bulging during an earlier leak in 1963 when waste was being added to the tank may have contributed. By March 8, 1965, increases in radiation in the 14-05-03 leak detection lateral indicted that fluids had escaped the tank and that the liner was ruptured. Waste was subsequently transferred from Tank 241-A-105 to other tanks, and liquid levels in Tank 241-A-105 were maintained at about 18 inches to control temperature to prevent deterioration of the concrete. Spray cooling water was added weekly to the tank from February 1971 to December 1978 to maintain liquid levels and temperatures, and some of this fluid is assumed to have leaked from the tank. This study examined available data to determine, to the extent possible, the distribution of the leaked constituents in surrounding soils and whether they migrated to groundwater. In this assessment, available data from gross gamma logging of dry wells and leak detection laterals as well as data from analyses of groundwater samples were examined throughout the period of interest. Logs of wells and photographs taken during construction of the 241-A-105 Tank Farm were also examined.

6446 (WHC-EP–0451) **Candidate reagents and procedures for the dissolution of Hanford Site single-shell tank sludges.** Schulz, W.W.; Kupfer, M.J. Westinghouse Hanford Co., Richland, WA (United States). Oct 1991. 34p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE92002257. Source: OSTI; NTIS; INIS; GPO Dep.

At least some of the waste in the 149 single-shell tanks (SST) at the US Department of Energy (DOE) Hanford Site will be retrieved, treated, and disposed of. Although the importance of devising efficient and cost-effective sludge dissolution procedures has long been recognized, a concerted bench-scale effort to devise and test such procedures with actual solids representative of those in Hanford Site SSTs has not been performed. Reagents that might be used, either individually or serially, to dissolve sludges include HNO_3, HNO_3-oxalic acid, and HNO_3-HF. This report consolidates and updates perspectives and recommendations concerning reagents and procedures for dissolving Hanford Site SST and selected double-shell tank (DST) sludges. The principal objectives of this report are as follows: (1) Compile and review existing experimental data on dissolution of actual Hanford Site SST and DST sludges. (2) Further inform Hanford Site engineers and scientists concerning the utility of combinations of thermally unstable complexants (TUCS) reagents and various reducing agents for dissolving SST and DST sludges. (This latter technology has recently been explored at the Argonne National Laboratory.) (3) Provide guidance in laying out a comprehensive experimental program to develop technology for dissolving all types of Hanford Site SST and DST sludges. 6 refs., 1 fig., 4 tabs.

6447 (WHC-EP–0465-Vol.3-Pt.B) **The analysis of the program to develop the Nuclear Waste Management System: Allocated requirements for the Office of Civilian Radioactive Waste Management Program: Volume 3, Part B.** Woods, T.W. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 718p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-87RL10930. Order Number DE92002971. Source: OSTI; NTIS; INIS; GPO Dep.

This report is volume 3, part B, of the program to satisfy the allocated requirements of the Office of Civilian Radioactive Waste Management Program, in the development of the nuclear waste management system. The report is divided into the following sections: regulatory compliance; external relations; international programs; strategic and contingency planning; contract business management; and administrative services. (CS)

6448 (WHC-EP–0492) **Office of Civilian Radioactive Waste Management decision methodology.** Hoessel, W.C. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 68p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-87RL10930. Order Number DE92003630. Source: OSTI; NTIS; INIS; GPO Dep.

The US Department of Energy (DOE) Office of Civilian Radioactive Waste Management (OCRWM), in its Management System Improvement Strategy, has identified the need for a uniform decision methodology to aid in structuring program choices. This report documents the initial effort to develop such a methodology. OCRWM decision problems typically require a delicate balancing of cost, schedule, safety, performance, and risk considerations. In addition, there are usually uncertainties associated with the values of the technical parameters. The problems are made even more complex by numerous stakeholders who have diverse and, often, conflicting views. The OCRWM decision methodology has been formulated with these issues in mind. The methodology was developed as a practical tool to assist OCRWM personnel in structuring problems and selecting a preferred solution from a set of alternatives. The decision methodology is composed of two elements. The first element is a general framework that provides guidelines for use in formulating decision problems. This framework consists of several discrete steps that, if followed, will result in a traceable, documented, and supportable decision rationale. The second element of the methodology is a process that selects the preferred alternative from a set of candidates.

6449 (WHC-EP–0508-Vol.2) **Parametric studies to support inspection criteria for the Hanford Site double-shell waste storage tanks: Volume 2.** Shurrab, M.S. (Westinghouse Hanford Co., Richland, WA (United States)); Thomson, M.D.; Friley, J.R.; Garnich, M.R.; Rinker, M.W.; Simonen, F.A. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 99p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC06-87RL10930 ;AC06-76RL01830. Order Number DE92003023. Source: OSTI; NTIS; INIS; GPO Dep.

Radioactive waste from the chemical processing of spent nuclear fuel has been stored in double-shell tanks at the Hanford Site since 1970. A program to assure that the tanks maintain their structural integrity requires an inspection plan. To support planning, calculations of stress, stress intensity factors and concrete creep rates were made. Stresses and stress intensity factors are for a tank subjected to normal loads. Results identify locations of the highest stress and where cracks, if present, would be most detrimental to tank integrity. The corresponding report contains three evaluations of tank stresses, two evaluations of stress intensity factors, an evaluation of the effects of concrete creep. These appendices provide calculational details made for the primary report.

6450 (WHC-SA-1190) **Safe storage of deactivated radiological chemical processing plants in the 200 West Area of the Hanford Site.** Egge, R.G. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 16p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. (CONF-910981-38: Environmental remediation '91 conference, Pasco, WA (United States), 8-11 Sep 1991). Order Number DE92002252. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes the surveillance and preventive maintenance actions that are implemented in the retired chemical processing plants (S Plant and U Plant) for the US Department of Energy Field Office, Richland (RL). These actions are intended to keep the facilities in a safe storage configuration until final decommissioning, scheduled to begin in 2007, can be accomplished. 4 figs., 2 tabs.

6451 (WHC-SA-1391) **Irradiation corrosion of waste package container materials in air/steam environment.** Anantatmula, R.P.; Colburn, R.P. Westinghouse Hanford Co., Richland, WA (United States). Nov 1991. 14p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. (CONF-9104326-1: The NACE annual conference and corrosion, Nashville, TN (United States), 27 Apr - 1 may 1991). Order Number DE92004543. Source: OSTI; NTIS; INIS; GPO Dep.

A set of corrosion tests of the candidate waste container materials for the Basalt Waste Isolation Project (BWIP) was conducted in a moist air environment simulating the repository preclosure condition. The tests were performed over a four-month period with air, saturated with moisture at 50°C, passing through test chambers holding specimens at 150°C and 250°C. The test materials included A27 cast carbon steel, A387 ferritic steel, oxygen-free copper and cupronickel 90-10. Each material was tested both with and without basalt/bentonite packing material adjacent to the specimens. For each combination of material, temperature and packing condition, tests were conducted at 10,000 R/hr and 100 R/hr radiation levels. All four materials tested at 250°C showed corrosion rates as much as an order of magnitude higher in the high radiation field when compared with similar tests without irradiation. Typically, the corrosion rates were lower at the lower dose rates, but were significantly higher at 100 R/hr compared to the case without radiation. At 150°C only pure copper showed enhanced corrosion due to gamma radiation. The presence of packing material adjacent to the specimens had no consistent effect on corrosion rate at either temperature.

6452 (YJT-90-04) **Permeability and long-term durability of concrete in final repository conditions.** Pihlajavaara, S. (Valtion Teknillinen Tutkimuskeskus, Helsinki (Finland)). Voimayhtioeiden Ydinjaetetoimikunta, Helsinki (Finland). Feb 1990. 61p. (In Finnish). Order Number DE92613960. Source: OSTI; NTIS (US Sales Only); INIS.

The interrelation of the permeability properties and longterm durability especially in wet repository conditions has been studied. The study is based on the author's long-term experience, literary survey and experiments on the durability, service life prediction, and on water and gas permeability. Degradation models and experimental results on water and gas permeability are presented. The experiments made indicated that high class concrete is practically water and gas tight, especially in the long run when stored under water. This meant that there will hardly be any mass transfer into concrete or out of it, if concrete is of good quality. Concrete structures can be designed to meet the required service life. It can be said that practically the precision increases and the scatter decreases in the service life estimation significantly when the thickness of the anticipated deteriorated surface layer is smaller due to the higher concrete quality. The service life of well-designed concrete silo walls made of high class concrete can be predicted to be at least 1000 years in the repository conditions. (orig.).

0530 Environmental Aspects

Refer also to citation(s) 6329, 6332, 6343, 6344, 6345, 6349, 6366, 6375, 6407, 6409, 6445, 6463, 7058, 7559, 7577, 7583, 7596, 7598, 7611, 7630, 7775

6453 (DOE/RL-90-32-Rev.1) **Phase 1 and 2 feasibility study report for the Hanford Site 1100-EM-1 Operable Unit: Revision 1.** USDOE Richland Operations Office, WA (United States). Aug 1991. 108p. Sponsored by U.S. DOE Environment Safety & Health. DOE Contract AC06-87RL10930. Order Number DE92002044. Source: OSTI; NTIS; GPO Dep.

This Draft Phase I and II Feasibility Study is based on data and conclusions from the Phase I Remedial Investigation Report for the Hanford Site 1100-EM-1 Operable Unit. No contamination of air or surface water occurs at the 1100-EM-1 Operable Unit, and contamination of groundwater will be addressed in the Phase III Feasibility Study. Chemicals of concern in soils are established to be bis(2-ethylhexyl)phthalate (BEHP) at the Discolored Soil Site, and polychlorinated biphenyls (PCBs) at the Horn Rapids Landfill. These data are summarized in Table 2-1. The following major conclusions from the Phase I Remedial Investigation report are the basis for this Phase I and II Feasibility Study: Risks to humans are minimal, calculated to be 2×10^{-6} for the entire 1100-EM-1 Operable Unit, and below the EPA's threshold value of 1×10^{-6} at each subunit, and risks to the environment are below levels of concern for any mechanism of transport considered. 20 refs., 5 figs., 9 tabs.

6454 (EUR-13434) **The geology, hydrogeology and geochemistry of the Needle's Eye natural analogue site.** Hooker, P.J. (British Geological Survey, Keyworth (UK). Fluid Process Research Group). Commission of the European Communities, Luxembourg (Luxembourg). 1991. 30p. Contract FI1W/0073 UK. Source: OSTI; NTIS (US Sales Only).

The British Geological Survey has been carrying out a research investigation of the Needle's Eye site at Southwick on the Solway coast in south-western Scotland. This study of a naturally radioactive geochemical system has the aim of improving our confidence in using predictive models of radionuclide migration in the geosphere. This summary report describes results from the integrated use of hydrogeological, mineralogical and geochemical techniques applied to the study of the transport and distribution of uranium. Pitchblende veins exposed in the cliffs are a major source of soluble uranium in ground-waters flowing into organic-rich post-glacial flood plain and intertidal mudflat deposits. Organic matter both living and dead has played a key role in the retardation of uranium in these sediments. Chemical transport modelling of the uranium dispersion/retardation is described and the implications for performance assessment work are discussed. Computer codes used: CHEMVAL (thermodynamic data base constants). CHIMERE (chemical equilibrium code). METIS (flow code). PHREEQE (chemical equilibrium code). STELE (coupled chemical transport code).

6455 (HAN-18510) **Suggested hydrologic investigations at the Hanford Directed Operations.** Piper, A.M. Geological Survey, Portland, OR (United States). 25 Aug 1948. 21p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE92004545. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This memorandum is an outline of hydrologic investigations that seem desirable at the Hanford Directed Operations of the Atomic Energy Commission. In its present form, the outline is tentative and is intended as a basis for further considerations in the Commission, the Geological Survey, and other agencies concerned. In scope, it seeks to cover (1) advisory functions to the Atomic Energy Commission and its prime contractor with respect to an evaluation of the continuing hazards due to process wastes, also with respect to water-supply problems of the expanding operations at Hanford; also (2) civilian-protection aspects of possible emergencies, especially in the region adjacent to the Hanford reservation.

0540 Health and Safety

Refer also to citation(s) 6334, 6359, 6360, 6366, 6372, 6374, 6405, 6417, 6421, 6444, 6478, 6784, 7169, 7565, 7613, 7808, 8448

6456 (DOE/RL–90-37-Rev.1) **Remedial investigation Phase 2 supplemental work plan for the Hanford Site 1100-EM-1 Operable Unit: Revision 1.** Department of Energy, Richland, WA (United States). Richland Operations Office. Sep 1991. 127p. Sponsored by U.S. DOE Environment Safety & Health. DOE Contract AC06-87RL10930. Order Number DE92002045. Source: OSTI; NTIS; GPO Dep.

The 1100 Area, the central warehousing, vehicle maintenance, and transportation operations center for the Hanford Site, was designated an (NPL) National Priorities List site in July 1989. This NPL site was divided into four operable units, and the first equipment maintenance operable unit, 1100-EM-1, was assigned the highest priority. The following summary focuses on the major issues related to contaminant sources, meteorology, surface hydrology, geology, pedology, hydrogeology, and ecology. The 110-EM-1 Phase 1 R1 report recommended further investigation at six waste management units assigned to or within the operable unit. 1100-1 (Battery Acid Pit)–an unlined dry sump, or french drain, used for the disposal of waste acid from vehicle batteries; 1100-2 (Paint and solvent Pit)–a former sand and gravel pit subsequently used for the disposal of construction debris and, reportedly, waste paints, thinner, and solvents; 1100-4 (Antifreeze Tank Site)–The site of a former underground storage tank used for the disposal of waste vehicle antifreeze; UN-1100-6 (Discolored Soil Site)–the location of an apparent disposal event onto the ground surface involving a container of organic waste liquids; Horn Rapids Landfill–a solid waste facility used primarily for the disposal of office and construction waste and the burning of classified documents; asbestos, sewage sludge, fly ash, and, potentially, drums of unidentified organic liquids alleged to be disposed at this location; and Ephemeral Pool–the location of 1100 Area parking lot runoff accumulation during infrequent, high-intensity precipitation events. This remedial investigation supplemental work plan details the efforts for final characterization of the 1100-EM-1 Operable Unit that will provide data to be used for the evaluation of remedial operations in the Phase 3 1100-EM-1 feasibility study. 19 refs., 28 figs., 2 tabs.

6457 (EGG-WTD–9899) **Technology status report: Transuranic contamination control at INEL.** Loomis, G.G. EG and G Idaho, Inc., Idaho Falls, ID (United States). Sep 1991. 16p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC07-76ID01570. Order Number DE92003264. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes proposed FY-92 work at the Idaho National Engineering Laboratory (INEL) in the field of contamination control during transuranic waste handling operations. The proposed work is both applied research and demonstration testing. The INEL needs for contamination control applied research and demonstration testing are listed along with a description of past accomplishments. The INEL proposal is compared to other proposals for contamination control work that are under consideration for funding by the Department of Energy. Benefits of this work and impacts of not sponsoring this work are also given. 21 refs.

6458 (ES/ER/TM–7) **Summary of the landfill remediation problems and technology needs of the Oak Ridge Reservation Environmental Restoration Programs.** Oak Ridge National Lab., TN (United States). Jan 1991. 97p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC05-84OR21400. Order Number DE92003714. Source: OSTI; NTIS; INIS; GPO Dep.

Presented by D.W. Swindle, Director, Technical Integration, Environmental Restoration Division at the DOE workshop on robotics for landfill remediation, Panama City, FL, January 9-10, 1991.

This report discusses the following topics: brief description of the Oak Ridge Reservation Environmental Restoration Program; descriptions of representative waste burials at each site; ongoing, planned, or potential remediation; known or anticipated remediation problems; potential applications for robotics in the remediation of Oak Ridge Reservation landfills.

6459 (HW–46104) **Manual of standard procedures for 100, 200, and 300 Area survey work.** Smith, J.M. Jr. (comp.). Hanford Works, Richland, WA (United States). 1 Dec 1949. 160p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE92002891. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report summarizes procedures and policies for the survey work in the 100, 200, and 300 areas of the Hanford Works. Topics include: health monitoring instruments, calibration, stationary instruments, portable instruments, special hazards bulletins, current permissible radiation exposure limits, standard procedure for skin decontamination, survey record sheets, air sampling, special work permits, protective clothing, contamination control, radiation danger zone tool room, decontamination, measurement of effluent water activity, the discharge area, hazard areas, radiation protection policies, uranium handling rules, and radiation hazards in the uranium processing buildings. (JL)

6460 (LA–12222-PR) **Health, Safety, and Environment Division annual report 1989.** Wade, C. (comp.). Los Alamos National Lab., NM (United States). Jan 1992. 69p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract W-7405-ENG-36. Order Number DE92005352. Source: OSTI; NTIS; GPO Dep.

The primary responsibility of the Health, Safety, and Environment (HSE) Division at the Los Alamos National Laboratory is to provide comprehensive occupational health and safety programs, waste processing, and environmental protection. These activities are designed to protect the worker, the public, and the environment. Meeting the responsibilities involves many disciplines, including radiation protection, industrial hygiene, safety, occupational medicine, environmental science and engineering, analytical chemistry, epidemiology, and waste management. New and challenging health, safety, and environmental problems occasionally arise from the diverse research and development work of the Laboratory, and research programs in the HSE Division often stem from these applied needs. These programs continue but are also extended, as needed, to study specific problems for the Department of Energy. The result of these programs is to help develop better practices in occupational health and safety, radiation protection, and environmental sciences.

6461 (ORAU–91/J-20) **Ionizing radiation risk assessment, BEIR IV.** Committee on Interagency Radiation Research and Policy Coordination, Washington, DC (United States). Oct 1991. 31p. Sponsored by U.S. Department of Defense. DOE Contract AC05-76OR00033. (CIRRPC–8). Order Number DE92004014. Source: OSTI; NTIS; INIS; GPO Dep.

This report of the Subpanel discusses the potential impact on Federal agencies and indicates individual risk factors that could be used by them in risk assessment. The approach used in this CIRRPC report was to consider the risk factors presented in BEIR IV for each radionuclide (or group radioelements) and to make some judgments regarding their validity and/or the uncertainties involved. The coverage of Radon-222 and its progeny dominated the BEIR IV report and this Subpanel felt is was proper to devote more attention to this radionuclide family. This risk factor presented in BEIR IV for radon is 350 cancer deaths per million person-working level months (WLM) of exposure for a lifetime. There is a range of opinions on the conversion from WLM to absorbed dose. As discussed in the text, the use of the WLM concept makes it difficult or infeasible to compare the risk factor for radon with that of other radionuclides which are based on organ dose. This report also includes a discussion of certain fundamental scientific and operational issues that may have decisive effect upon risk factor selection. These adjunct items are dealt with under separate headings and include discussions of threshold dose considerations, extrapolation to low doses, and age at exposure.

6462 (ORNL/ER–60) **Annual summary report on surveillance and maintenance activities of the surplus contaminated facilities program at Oak Ridge National Laboratory for period ending September 30, 1991.** Cannon, T.R.; Ford, M.K.; Holder, L. Jr. Oak Ridge National Lab., TN (United States). Sep 1991. 5p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC05-84OR21400. Order Number DE92003745. Source: OSTI; NTIS; INIS; GPO Dep.

The Surplus Contaminated Facilities Program (SCFP) was established at the Oak Ridge National Laboratory (ORNL) in 1985 to provide support for inactive contaminated facilities that were largely abandoned by the programs which they formerly served. This support provides for routine surveillance and maintenance (S&M) and special projects beyond a routine nature when such actions are needed to ensure adequate protection of personnel or the environment. The facilities included in the program had been used for research, technology development, isotope production and processing, and waste management. Support for facilities in the SCFP has previously been provided by the Department of Energy's (DOE's) Office of Energy Research: Multiprogram Energy Laboratories – Facilities Support (ERKG) because of multiprogram use of the facilities or because of the landlord responsibility of Energy Research. Recently, an integrated Decontamination and Decommissioning (D&D) program within the DOE Office of Environmental Restoration and Waste Management has been established to collectively manage the former Surplus Facilities Management Program, Defense D&D Program, and the KG-funded, ORNL-originated SCFP. This report gives an overview of the S&M planning, routine S&M, and special maintenance project activities which have occurred at the SCFP facilities during the 1991 Fiscal Year.

6463 (ORNL/RASA–89/18) **Results of the Radiological Survey at Conviber, Inc., 644 Garfield Street, Springdale, Pennsylvania (CVP001).** Foley, R.D.; Cottrell, W.D.; Crutcher, J.W. Oak Ridge National Lab., TN (United States). Health and Safety Research Div. Oct 1991. 19p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC05-84OR21400. Order Number DE92004589. Source: OSTI; NTIS; INIS; GPO Dep.

As part of the Formerly Utilized Sites Remedial Action Program (FUSRAP), the US Department of Energy (DOE) is implementing a radiological survey program to determine the radiological conditions at sites that were used by the department's predecessor agencies. During the mid-1940s, and possibly continuing until 1951, the Conviber site in Springdale, Pennsylvania, was used to machine extruded uranium in support of government efforts. In 1980 a radiological scanning survey of this site was conducted by DOE and Argonne National Laboratory (ANL) staffs. Their report noted one anomaly: elevated radiation levels over a small area inside the building where uranium had been machined. Because much of the floor was inaccessible, for surveying and because of the lack of definitive records documenting use of this site, a comprehensive radiological assessment was recommended. The radiological survey discussed in this report for the site of Conviber, Inc., Springdale, Pennsylvania, was conducted by members of the Measurement Applications and Development Group of Oak Ridge National Laboratory in June of 1989. The survey included a surface gamma scan, collection of concrete and soil samples, and measurement of direct and removable alpha and beta-gamma contamination. One indoor location with a gamma measurement of 20 μR/h was found. In June of 1990 ORNL staff returned to investigate the location with elevated gamma. A hole was drilled through the concrete, gamma measurements were taken, and soil samples were obtained for analyses. In these eight indoor soil samples, concentrations of ^{238}U ranged from 90 to 20,000 pCi/g. However, under current site use, residual uranium covered by concrete does not pose a health risk.

6464 (WHC-EP–0405-Draft.A-Vol.3) **Systems engineering study for the closure of single-shell tanks: Draft A, Volume 3.** Boomer, K.D.; Baker, S.K.; Boldt, A.L.; Britton, M.D.; Engelsman, L.E.; Galbraith, J.D.; Garfield, J.S.; Giese, K.A.; Golberg, C.E.; Higley, B.A.; Hull, K.J.; Johnson, L.J.; Knight, R.P.; Layman, J.S.; Marusich, R.S.; Parazin, R.J.; Piepho, M.G.; SlaathaugWestinghouse Hanford Co., Richland, WA (United States). Aug 1991. 369p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE92003140. Source: OSTI; NTIS; INIS; GPO Dep.

Disposal alternatives of single shell tank wastes (SSTs), high-level and transuranic wastes, are being evaluated at the Hanford Reservation. This report, volume 3, draft a, contains appendices on the following: public involvement; incremental impact of double-shell tank waste to SST waste functions; SST radionuclide and chemical information; evaluation of alternatives and; waste retrieval and transfer. (CBS)

6465 (WHC-EP–0427-Pt.2) **Hanford Waste Vitrification Systems Risk Assessment: Final report supporting information: Part 2.** Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 482p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE92003284. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains Double-shell Tank Waste Risk Analysis Forms. The worksheets prepared in developing assessments on individual activities are presented in this appendix. The assessment of each schedule activity required completion of a minimum of three forms, a Risk Analysis Results Form, an Input to Science Applications International Corporation (SAIC) Form, and an Uncertainty Report Form. A Risk Analysis Results Form was used to identify the assessments made with respect to a given activity. An Input to SAIC Form was used to identify the optimistic, most likely, and pessimistic costs and durations for the activity, as well as the probability of completing the activity within the most likely duration. The rationale used in developing the input is also provided in this appendix. The activity assessment worksheets are grouped by the seven major program activities, i.e., characterization, retrieval, pretreatment technology, pretreatment facilities, Hanford Waste Vitrification Plant, grout, and Tank Farms.

6466 (WHC-EP–0474-1) **Quarterly report on Defense Nuclear Facilities Safety Board Recommendation 90-7.** Cash, R.J. Westinghouse Hanford Co., Richland, WA (United States). Aug 1991. 43p. Sponsored by U.S. DOE Environment Safety & Health. DOE Contract AC06-87RL10930. Order Number DE92002188. Source: OSTI; NTIS; GPO Dep.

This is the first quarterly report on the progress of activities addressing safety issues associated with Hanford Site high-level radioactive waste tanks than contain ferrocyanide compounds. An implementation plan (Cash 1991) responding to the Defense Nuclear Facilities Safety Board Recommendation 90-7 (FR 1990) was issued in March 1991 describing the activities planned and underway to address each of the six parts of the recommendation. All of the activities listed in the implementation plan are underway. Although a lack of full funding, technical difficulties, and resource limitations delayed some of the work, noteworthy progress has been made in achieving many of the milestones. The progress made includes the following. Thermal modeling shows that significant hot spots within the waste are highly unlikely, if not impossible. Continuous temperature monitoring was installed ahead of schedule on two of the highest interest tanks, and five additional tanks will be on-line in September with 10 tanks total on-line by December. Accuracy checks of tank instrument trees show most thermocouples are reading correctly. Tank intrusive sampling is proceeding, and the first core samples will be obtained on schedule in October. Chemical reaction studies are underway with synthetic ferrocyanide compounds believed to be more representative of the ferrocyanide materials actually deposited in the tanks. Tests indicate that water plays a major role in impeding a possible runaway reaction. An emergency planning exercise was conducted in May, and a validation of updated procedures and a second emergency exercise is scheduled for October. 13 refs., 2 figs., 3 tabs.

6467 (WHC-EP–0474-2) **Quarterly report on Defense Nuclear Facilities Safety Board Recommendation 90-7.** Cash, R.J.; Dukelow, G.T. Westinghouse Hanford Co., Richland, WA (United States). Oct 1991. 78p. Sponsored by U.S. DOE Environment Safety & Health. DOE Contract AC06-87RL10930. Order Number DE92004566. Source: OSTI; NTIS; INIS; GPO Dep.

This is the second quarterly report on the progress of activities addressing safety issues associated with Hanford Site high-level radioactive waste tanks that contain ferrocyanide compounds. An implementation plan (Cash 1991) responding to the Defense Nuclear Facilities Safety Board Recommendation 90-7 (FR 1990) was issued in March 1991 describing the activities planned and underway to address each of the six parts of the recommendation. All of the activities listed in the implementation plan are underway, including the multifunctional instrument tree and infrared tasks which resumed in late July. Although technical difficulties and resource limitations delayed some work, noteworthy progress has been made in completing a number of ferrocyanide program milestones.

Thermal modeling shows that the heat loading of tank 241-BY-104 is much lower than previously listed and that significant hot spots within the waste are highly unlikely, if not possible. Computerized continuous temperature monitoring was installed on schedule on five of the highest interest tanks and five additional tanks will be on-line in December. Tank intrusive sampling is proceeding and the first vapor samples were obtained in mid-October. Spectral scans were completed for twelve tanks and substantial progress was made on design of an infrared scanning system. Chemical reaction studies are underway with synthetic ferrocyanide compounds believed to be more representative of the ferrocyanide materials actually deposited in the tanks. Tests indicate that water plays a major role in impeding a possible runaway reaction. An emergency planning exercise was conducted in May, emergency procedures were updated this quarter, and validation of the procedures and a second emergency exercise is scheduled for October.

6468 (Y/ER–19) **Revised RCRA Closure Plan for the Interim Drum Yard (S-030) at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee: Revision of Y/TS-347/1R3.** Oak Ridge Y-12 Plant, TN (United States). Aug 1991. 26p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC05-84OS21400. Order Number DE92003900. Source: OSTI; NTIS; INIS; GPO Dep.

The Interim Drum Yard (S-030) is an outdoor storage area for containerized hazardous waste. The yard is constructed of gravel on native soil and has no liner or containment system. Drums of waste are stored on wooden pallets. A list of wastes that are or have been stored at this facility is given in this report. This report discusses inventory removal, disposal, and decontamination. 4 refs., 3 figs., 4 tabs.

0550 Safeguards, Inspection, and Accountability

Refer also to citation(s) 6328, 6481, 6697

6469 (ENEA-RT-NUCL–90-24) **Fissile material safeguards: Technological aspects.** Aparo, M.; Grossi, G.; Frazzoli, F.V.; Remetti, R. ENEA, Casaccia (Italy). Area Nucleare; Rome Univ. (Italy). Dipt. di Energetica. Jun 1991. 52p. (In Italian). (RT/NUCL–90-24). Order Number DE92744028. Source: OSTI; NTIS (US Sales Only).

A short description of the need for nuclear materials safeguards and of their historical-political evolution introduces, as the main topic, an overview of the technical features of safeguard systems. Particular attention is devoted to fissile material measuring processes in current use and those under the research and development phase. The final topic focuses on possible extensions of safeguard methodologies to fields other than the nuclear one.

6470 (IAEA-INFCIRC–396) **Letter of 5 December 1991 to the Director General from the Resident Representative of Iraq to the Agency.** International Atomic Energy Agency, Vienna (Austria). 7 Jan 1992. 4p. Order Number DE92615192. Source: OSTI; NTIS (US Sales Only); INIS.

Hard copies are available in Arabic and English from IAEA Division of Publications, Distribution Unit.

The document reproduces a letter dated 5 December 1991 to the Director General of the IAEA from the Resident Representative of Iraq to the International Atomic Energy Agency concerning the presentation of a Distinguished Service Award to Mr. David Kay for his activity in the Safeguard inspections in Iraq (Attachment 1). The Director General's reply is reproduced in Attachment 2.

6471 (IAEA-R–4273-F) **Laser surveillance system (LASSY).** Boeck, H. International Atomic Energy Agency, Vienna (Austria). Sep 1991. 13p. Order Number DE92615187. Source: OSTI; NTIS (US Sales Only); INIS.

Laser Surveillance System (LASSY) is a beam of laser light which scans a plane above the water or under-water in a spent-fuel pond. The system can detect different objects and estimates its coordinates and distance as well. LASSY can operate in stand-alone configuration or in combination with a video surveillance to trigger signal to a videorecorder. The recorded information on LASSY computer's disk comprises date, time, start and stop angle of detected alarm, the size of the disturbance indicated in number of deviated points and some other information. The information given by the laser system cannot be fully substituted by TV camera pictures since the scanning beam creates a horizontal surveillance plan. The engineered prototype laser system long-term field test has been carried out in Soluggia (Italy) and has shown its feasibility and reliability under the conditions of real spent fuel storage pond. The verification of the alarm table on the LASSY computer with the recorded video pictures of TV surveillance system confirmed that all alarm situations have been detected. 5 refs.

6472 (KAERI/RR–966/90) **Studies on the establishment of nuclear safety policy.** Koh, Byung Ryung (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Ko, Seong Eun; Park, Yun Pyo; Hong, Eon Yung; Lee, Byoung Oon. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1991. 159p. (In Korean). Order Number DE92615186. Source: OSTI; NTIS (US Sales Only); INIS.

The purpose of these studies, as the first step to enhance the safety and confidence on nuclear facilities, is to establish a long-term plan for nuclear safety researches including environmental monitoring. These studies have been performed for two parts (long-term plan for nuclear safety researches and improvement on environmental radiation monitoring). The results of 1990 studies and the plan of the future studies are as follows: 1. A Long-Term Plan for Nuclear Safety Researches The research direction and status of nuclear safety of the nuclear advanced countries, such as the U.S.A. and Japan, have been analyzed and compared to those of Korea. Based on these results, a long-term nuclear safety research plan have been suggested for eight areas (1. Severe Accident, 2. PRA, 3.Thermo-Hydraulic Transients, 4.Inspection and Maintenance for Operating Plant, 5. Seismology, 6. Human Factors, 7.Radioactive Waste Management, 8. Environmental Safety). In the future, the implementation methods including budget and manpower development program will be studied, and discussed with the government and related organizations to establish the final plan. 2. Improvement in Environmental Radiation Monitoring System The practice system, law and program of environmental radiation monitoring of the U.S.A. and Japan are surveyed and analyzed to provide the improvement in the domestic environmental radiation monitoring system. The results of these studies will be used in setting up the national provisions for environmental radiation monitoring system. (Author).

6473 (LA–12214-M) **THIEF: An interactive simulation of nuclear materials safeguards and security.** Stanbro, W.D.; Henriksen, P.W. Los Alamos National Lab., NM (United States). Dec 1991. 20p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE92004116. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This users manual is a guide to THIEF 2.0, an interactive simulation of safeguards and security at a nuclear facility. The program allows the user to create a model of a particular nuclear facility along with its safeguards features and then play the part of an adversary trying to steal special nuclear material from the facility. The program runs on IBM PC-compatible microcomputers with a minimum of 640 kbytes of RAM, and EGA or VGA graphics card, and preferably a color monitor.

6474 (LA-UR–91-3559) **Miniature-MCA technology developments.** Halbig, J.K.; Klosterbuer, S.F.; Stephens, M.M.; Biddle, R.S. Los Alamos National Lab., NM (United States). [1991]. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-911106–36: IEEE nuclear science symposium, Santa Fe, NM (United States), 5-9 Nov 1991). Order Number DE92003856. Source: OSTI; NTIS; GPO Dep.

We have recently reduced the size of multichannel analyzers (MCAs) and have implemented more features in hardware to relieve software requirements. We built and tested a spectroscopy grade, 4096-channel MCA. Exclusive of amplifier and power supply, it fits on two boards each approximately 7 by 15 cm. This paper discusses the features and performance of the analyzer and some reasonable applications of these technologies.

6475 (MLM–3724(OP)) **Retrofittable electrical heater standard for the calibration of heat flow calorimeters.** Kasperski, P.W.; Wetzel, J.R.; Duff, M.F.; Fultz, R.L.; Breakall, K.L.; Renz, D.P. EG and G Mound Applied Technologies, Miamisburg, OH (United States). [1991]. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-88DP43495. (CONF-910901–24: 4. international conference on facility operations/safeguards interface, Albuquerque, NM (United States), 29 Sep - 4 oct 1991). Order Number DE92004011. Source: OSTI; NTIS; INIS; GPO Dep.

The possibility of using a nonnuclear source for calorimeter calibration has been discussed for several years. The use of electrical heaters to replace the currently used plutonium 238 sources had been taken into consideration, but until the currently used calorimeter electronics were developed, this consideration was not a practical one. An electrical resistance heater has been developed at Mound to replace the currently used plutonium 238 standards. The use of this heater should alleviate problems caused by the use of fissile materials in the laboratory in regard to environmental, safety and health concerns. Its replacement of the Pu 238 standards will also alleviate the problems and expense incurred with the transportation of SNM's between the Labs which is currently required for their calibration. The electrical standard that was developed at Mound is a very practical device that can be inexpensively produced for wide use in DNA labs throughout the complex. It has a wide range of operation, and can be designed for use in practically any calorimeter. The data reproduced here illustrates that the output from a device such as this is extremely close to the power output produced from the traditional plutonium standards. A mathematical correction factor can be applied to the curve produced by the heater output data so that this curve replicates the PU 238 data curve. This will allow the replacement of the plutonium heat standards by the electrical heater for use in calorimeter calibration. 2 refs.

6476 (NUREG–1322) **Acceptance criteria for the evaluation of Category 1 fuel cycle facility physical security plans.** Dwyer, P.A. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Safeguards and Transportation. Oct 1991. 26p. Sponsored by Nuclear Regulatory Commission. Source: OSTI; NTIS; INIS; GPO.

This NUREG document presents criteria developed from US Nuclear Regulatory Commission regulations for the evaluation of physical security plans submitted by Category 1 fuel facility licensees. Category 1 refers to those licensees who use or possess a formula quantity of strategic special nuclear material.

6477 (NUREG/CR–5722) **Interior intrusion detection systems.** Rodriguez, J.R. (Sandia National Labs., Albuquerque, NM (United States)); Matter, J.C.; Dry, B. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Safeguards and Transportation; Sandia National Labs., Albuquerque, NM (United States); BE, Inc., Barnwell, SC (United States). Oct 1991. 100p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC04-76DP00789. (SAND–91-0948). Source: OSTI; NTIS; INIS; GPO.

The purpose of this NUREG is to present technical information that should be useful to NRC licensees in designing interior intrusion detection systems. Interior intrusion sensors are discussed according to their primary application: boundary-penetration detection, volumetric detection, and point protection. Information necessary for implementation of an effective interior intrusion detection system is presented, including principles of operation, performance characteristics and guidelines for design, procurement, installation, testing, and maintenance. A glossary of sensor data terms is included. 36 figs., 6 tabs.

6478 (PNL–7871) **Savannah River Restart Peer Evaluation Program final examination report.** Morgan, M.P.; Draper, D.G. Pacific Northwest Lab., Richland, WA (United States). Dec 1991. 61p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE92004849. Source: OSTI; NTIS; GPO Dep.

During the period of August 13, 1990 through September 6, 1991 the Savannah River Peer Evaluation Program was administered during three distinct phases to 73 certified Central Control Room Operators, Central Control Room Supervisors, and Shift Technical Engineers assigned to the K Reactor, on the Savannah River Site (SRS). This program was conceived and developed by the Department of Energy (DOE) and it's implementation satisfies recommendations made by the Defense Nuclear Facilities Safety Board. The review identified both strengths and weaknesses of the procedures and personnel.

6479 (UCRL-ID–106454-91-1) **Lawrence Livermore National Laboratory safeguards and security quarterly progress report to the Department of Energy Office of Safeguards and Security, quarter ending March 31, 1991.** Ruhter, W.D.; Al-Ayat, R.; Cole, C.E.; Thomas, L.L. Lawrence Livermore National Lab., CA (United States). Apr 1991. 31p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE91015088. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This progress report summarizes the quarterly activities for four programs at Lawrence Livermore National Laboratory (LLNL). The Safeguards Technology Program (STP) at Livermore supports the Technology Development Program of the Office of Safeguards and Security (OSS) in three subprogram areas (tasks): (1) Science and Technology Base Development; (2) Onsite Testa and Evaluation and Facility Support; and, (3) International Safeguards. The overall goal of the Safeguards Systems Studies program is to provide state-of-the-art analytic tools for evaluating the effectiveness of safeguards and security systems. These tools should address the spectrum of threats including theft and sabotage of nuclear material by nonviolent or violent insiders. Tools developed are to transferred to the users community. The overall goal of the Computer Security – Distribution Systems program is to conduct research and development into network security monitoring, computer virus and malicious code defensive mechanisms, system security maintenance software, distributed audit standards and requirements, a vulnerability reporting program, and system integrity concepts. The primary effort of atomic vapor laser isotope separation (AVLIS) work is to ensure coordination of the AVLIS safeguards and security systems RD&D. It provides planning, support and independent review of safeguards and security system requirements to ensure they are cost effective and integrated into the AVLIS equipment and systems, design and operation; and, plan and support safeguards instrumentation technology to evaluate and develop the instrumentation for detection of HEU production in an AVLIS separator.

6480 (UCRL-JC–104494) **A nuclear material sampling plan.** Parrish, C.P.; Mensing, R.W. Lawrence Livermore National Lab., CA (United States). Jul 1990. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9007106–86: 31. Institute of Nuclear Materials Management (INMM) conference, Los Angeles, CA (United States), 15-18 Jul 1990). Order Number DE92003975. Source: OSTI; NTIS; GPO Dep.

DOE Order 5633.3 requires that the accountable nuclear material holdings be inventoried at bi-monthly, semi-annual and annual intervals. This paper will describe a sampling plan designed to bound the total inventory difference. It is used in conjunction with a computerized nuclear material accountability system. The computer executes a statistical algorithm for selecting inventory items for measurement and produces a report listing those items to be inventoried. Based on verification or confirmatory measurements of the inventoried items, the computer calculates the estimated total inventory difference and accepts or rejects a hypothesis of no inventory difference. If the hypothesis is not rejected, one concludes, with specified level of confidence, that the total inventory difference is less than a specified threshold value. The computer maintains a permanent data base describing the inventory items sampled and the results of the statistical analysis.

0560 Legislation and Regulations

Refer also to citation(s) 6328, 6469, 6613, 6614, 6616, 6624

6481 (IAEA-INFCIRC–207(Add.2)) **Notification to the Agency of exports and imports of nuclear material.** International Atomic Energy Agency, Vienna (Austria). Dec 1991. 2p. Order Number DE92615174. Source: OSTI; NTIS (US Sales Only); INIS.

The document reproduces the letter dated 15 November 1991 received by the Director General of the IAEA from the Resident Representative to the Agency of the People's Republic of China, informing him that, in the interest of assisting the Agency in its safeguards activities, the Government of the People's Republic of China had decided to provide it henceforth with information on exports and imports of nuclear material.

6482 (INIS-BR–2878) **Radioactive lightning-aresters: protection or danger?** Heilbron Filho, P.F.L.; Xavier, A.M. Comissao Nacional de Energia Nuclear (CNEN), Rio de Janeiro, RJ (Brazil). Sep 1991 18p. (In Portuguese). Order Number DE92614089. Source: OSTI; NTIS (US Sales Only); INIS.

The main works that served as technical support for the resolution 04/89, that stop with the concession of authorization for using radioactive materials in lightning arresters are described. (author).

6483 (INIS-GB–387) **Proposed Food (Control of Irradiation) Regulations 1990.** Department of Agriculture and Fisheries for Scotland, Edinburgh (United Kingdom). Aug 1990 4p. Order Number DE92615177. Source: OSTI; NTIS (US Sales Only); INIS.

The paper summarizes proposals UK Ministry of Agriculture, Fisheries and Food Proposals for part of a comprehensive range of controls applying to premises using sources of ionising radiation in the processing of food. (UK).

6484 (INIS-XN–353) **Act No 6 of 13 March 1981 concerning protection against pollution and concerning waste (the Pollution Control Act).** Norway. 27 Mar 1981 35p. (In Norwegian). Order Number DE92615179. Source: OSTI; NTIS (US Sales Only); INIS.

Published in Norsk Lovtidend No. 9.

The purpose of this Act is to counteract pollution of the environment and to promote improved treatment of waste, including radioactive waste. It entered into force in 1982.

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

6485 (INCT–2070-2073/IChTJ/D/A,B-V.1,2) **Application of radioisotopic techniques in industry, medicine and environment protection: V. 1.** Institute of Nuclear Chemistry and Technology, Warsaw (Poland). 1988. 562p. (In Polish). (CONF-8703340–: National symposium on application of radioisotope techniques in industry, medicine and environment protection, Warsaw (Poland), 31 Mar - 3 apr 1987). Order Number DE92613704. Source: OSTI; NTIS (US Sales Only); INIS.

Report received in 1990.

Separate abstracts were prepared for 9 of the papers in this volume. The remaining 21 papers were considered outside the subject scope of INIS. (A.S.).

0701 Physical Isotope Separation

Refer also to citation(s) 7137

6486 (KAERI/RR–939/90) **Research on the optical applications in nuclear industry.** Kim, Cheol Jung (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Shin, Jang Soo; Lee, Sang Mock; Roh, Si Pho; Baik, Sung Hoon; Kwon, Seong Ouk; Hong, Suk Kyong. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1991. 223p. (In Korean). Order Number DE92615024. Source: OSTI; NTIS (US Sales Only); INIS.

For IRMPA/D (Infrared Multi-photon Absorption /Dissociation) studies, we measured IR fluorescence emitted from vibrationally excited DF* or HF* produced in IRMPD of CDF^3/CHF^3 using ir monochromator and InSb ir detector. We could detect the ir fluorescence of HF from the sample mixture CDF^3/CHF^3 to which the CDF^3 was selectively irradiated. This means that the molecular selective excitation of CDF^3 in CDF^3/CHF^3 mixture did not give molecular selective dissociation of CDF^3 because of the fast intermolecular vibrational energy transfer from the excited state CDF^3 to the ground state CHF^3. This technique will play important role for measuring isotope selectivity in IRMPD of CDF^3/CHF^3. We developed data analysis technique for the laser fluorometer to improve analytical speed and accuracy. We calculated a fluorescence intensity at time zero using two values obtained by integration of two intervals on time-resolved fluorescence signal. Applying this method, we could eliminate any interference effects from quenching elements or temperature fluctuations of samples, effectively. The applications of the instrument were broadened to the analyses of rare-earth elements and the trace analyses of Sm, Eu, Tb and Dy were successfully performed. To improve resolution of the hologram, a bleaching method of silver halide emulsion hologram was investigated. The optimum condition for making transmission phase hologram of the silver halide photographic plate was also studied. The effects of the developer, the bleaching solution and the drying process were experimentally measured. The new recording geometry of the reflection hologram with high resolution and high efficiency was investigated theoretically and experimentally. And we compared this new method with conventional one. (Author).

6487 (UCRL–53868-90, pp. 4.19-4.23) **Preventing seizure of sliding-contact bearings in hot, high-vacuum environments.** Mosleh, M. (Massachusetts Inst. of Tech., Cambridge (United States)); Suh, N.P.; Stowers, I.F. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

The goals of this research are to extend the operating life of dry, sliding-contact bearings in high-vacuum, high-temperature environments and to prevent their premature seizure. The authors have designed and built a high-vacuum apparatus (10^{-6} Torr) and used it to conduct high-temperature friction and wear tests on a sliding-contact bearing assembly consisting of a copper shaft rotating in a stationary stainless steel bushing. The approach taken to solving the friction problem is to make the surface of the shaft undulated (wavy) rather than smooth. Undulated surfaces have low-friction characteristics due to their ability to trap wear particles and prevent them from agglomerating, which appears to be the ultimate cause of seizure.

0702 Radiation Sources

Refer also to citation(s) 6797, 6836, 7104, 7105, 7121, 7127, 7129, 7191, 7192

6488 (INCT–2070-2073/IChTJ/D/A,B-V.1,2) **Application of radioisotopic techniques in industry, medicine and environment protection: V. 2.** Institute of Nuclear Chemistry and Technology, Warsaw (Poland). 1988. 562p. (In Polish). (CONF-8703340–: National symposium on application of radioisotope techniques in industry, medicine and environment protection, Warsaw (Poland), 31 Mar - 3 apr 1987). Order Number DE92613705. Source: OSTI; NTIS (US Sales Only); INIS.

Report received in 1990.

Separate abstracts were prepared for 14 of the papers in this volume. The remaining 7 papers were considered outside the subject scope of INIS. (A.S.).

6489 (INIS-SU–290, pp. 73-74) **Equipment for production of Radplast products, their basic characteristics and selection.** Danilov, V.G.; Chepel', L.V.; Nevzorova, O.N.; Mamistova, O.V. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. ORGANIC POLYMERS/chemical radiation effects; ORGANIC POLYMERS/production; ELECTRON BEAMS; IRRADIATION DEVICES; PRODUCTION; SHRINKAGE; SPECIFICATIONS; TUBES; USES

6490 (INIS-SU–290, pp. 75) **Analysis of the experience of development and prospects of the use of radiation-chemical treatment of farm sewage.** Denisenko, M.F. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po

Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. BIOLOGICAL WASTES/irradiation; BIOLOGICAL WASTES/waste processing; ANIMAL BREEDING; IRRADIATION; ELECTRON BEAMS; IRRADIATION DEVICES; LIQUID WASTES; POLLUTION ABATEMENT

6491 (INIS-SU–290, pp. 76) **Parametric series of cells for irradiation of farm sewage by accelerated electrons.** Denisenko, M.F. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. BIOLOGICAL WASTES/irradiation; BIOLOGICAL WASTES/waste processing; ANIMAL BREEDING; IRRADIATION; ELECTRON BEAMS; IRRADIATION DEVICES; MEV RANGE 01-10; POLLUTION ABATEMENT; SPECIFICATIONS

6492 (INIS-SU–290, pp. 77) **Reduction of ecological and energetic overload near large swineries under combined application of electron accelerators.** Denisenko, M.F. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. BIOLOGICAL WASTES/irradiation; BIOLOGICAL WASTES/waste processing; ANIMAL BREEDING; IRRADIATION; ECOLOGY; ELECTRON BEAMS; IRRADIATION DEVICES; POLLUTION ABATEMENT

6493 (INIS-SU–290, pp. 78) **Radiation processing of farm wastes and plant growing wastes into feed additives.** Denisenko, M.F. (Belorusskij Gosudarstvennyj Univ., Minsk (Byelorussian SSR)); Kurilovich, M.M.; Sosnovskaya, A.A. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. BIOLOGICAL WASTES/waste processing; ANIMAL BREEDING; ANIMAL FEEDS; ELECTRON BEAMS; IRRADIATION; IRRADIATION DEVICES; RADIATION DOSES; SPECIFICATIONS; WASTE PRODUCT UTILIZATION

6494 (INIS-SU–290, pp. 79) **Technology of farm sewage processing with accelerated electrons.** Denisenko, M.F. (Belorusskij Gosudarstvennyj Univ., Minsk (Byelorussian SSR)); Kurilovich, M.M.; Bogdanovich, T.V.; Gonchar, A.P.; Petryaev, E.P.; Sosnovskaya, A.A.; Subbotina, N.N. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. BIOLOGICAL WASTES/irradiation; BIOLOGICAL WASTES/waste processing; ANIMAL BREEDING; IRRADIATION; ELECTRON BEAMS; IRRADIATION DEVICES

6495 (KAERI/RR–978/90) **Studies on the improvement of irradiation process.** Kim, Ki Yup (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Pyun, Hyung Chick; Jin, Joon Ha; Yoon, Byung Mok; Nho, Young Chang; Lee, Young Keun; Park, Soon Cheol; Na, Bong Joo; Yoo, Young Soo. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Feb 1991. 70p. (In Korean). Order Number DE92615038. Source: OSTI; NTIS (US Sales Only); INIS.

According to the transfer of irradiation facilities such as 110 kCi Co-60 irradiator, 1 kCi Co-60 irradiator and 300 keV electron beam accelerator from Seoul to Taejon, there is in need of preparations for the re-establishment and safe operation of the facilities. Maintaining optimal condition of the facilities is essential to meet the needs from industries, institutes, universities and regional cooperative programs. Efficient management of the facilities as well as process improvement of irradiation is also significant for the promotion of radiation processing technology which can contribute to energy saving and environment preservation. The present process of 110 kCi Co-60 irradiator for sterilization of medical products was improved by redesigning the carrier system so that even bulky samples can be irradiated. Radiation safety of 1 kCi Co-60 irradiator could be strengthened through the modification of operation protocol and safety systems. The present conveyor system of electron beam accelerator suitable only for thin samples was improved so that even bulky sample could be irradiated. The improved conveyor system was designed with mobile wheel, and irradiation room was designed with rail on the floor. To prevent the loss of insulating gas from disassembling of power supply and accelerator, a recovery apparatus of the gas was prepared. (Author).

6496 (KAERI/RR–985/90) **Study on industrial application of radiotracer: Measurement of mixing rates of powdered raw materials.** Kim, Jae Rok (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); You, Young Soo; Jin, Joon Ha; Han, Hyeon Soo; Park, Choon Deuk. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Mar 1991. 50p. (In Korean). Order Number DE92615042. Source: OSTI; NTIS (US Sales Only); INIS.

Mixing rates of powdered raw materials of welding electrodes were measured using technetium-99m adsorbed raw material components as tracer. (1) Adsorbed technetium-99m was not detached during studies. (2) Taking more than 10 samples of the smallest possible but equal size at definite mixing stages were important in assuring reliability. (3) Mixing rates were independent on mixing ratio of the two components insofar as the specific gravity and grain size are same. (4) Mixing rates were inversely proportional to the specific gravity and grain size but proportional to mixing ratios in case of the specific gravity difference was more than 1.5. (Author).

6497 (WHC-SA–1259-Rev.1) **Modification of hot cells for general purpose heat source assembly at the Radioisotope Power Systems Facility: Revision 1.** Carteret, B.A. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 10p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-87RL10930. (CONF-920104–4-Rev.1: 9. symposium on space nuclear power systems, Albuquerque, NM (United States), 13-16 Jan 1992). Order Number DE92001807. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Eight existing, unused hot cells currently are being modified for use in the Radioisotope Power Systems Facility (RPSF) to assemble ^{238}Pu-fueled heat sources for Radioisotope Thermoelectric Generators (RTGs). Four air atmosphere cells will be used for storage, decanning, and decontamination of the iridium-clad radioisotope fuel. The remaining four argon atmosphere cells will be used to assemble fuel and graphite components for production and packaging of general purpose heat source (GPHS) assembly modules, which provide heat to drive the thermoelectric conversion process in the generators. The hot cells will be equipped to perform remote and glovebox-type operations. They will provide shielding and contamination control measures to reduce worker radiation exposure to levels within current US Department of Energy (DOE) guidelines. Designs emphasize the Westinghouse Hanford Company (Westinghouse Hanford) as low as reasonably achievable (ALARA) radiation protection policy. 3 refs., 3 figs.

0706 Environmental Aspects

6498 (INIS-mf–13058) **Facts about food irradiation: Safety of irradiation facilities.** ICGFI fact series. International Consultative Group on Food Irradiation (ICGFI). Food and Agriculture Organization of the United Nations, Rome (Italy); World Health Organization, Geneva (Switzerland); International Atomic Energy Agency, Vienna (Austria). May 1991 4p. Order Number DE92613601. Source: OSTI; NTIS (US Sales Only); INIS.

This fact sheet considers the safety of industrial irradiation facilities. Although there have been accidents, none of them has endangered public health or environmental safety, and the radiation processing industry is considered to have a very good safety record. Gamma irradiators do not produce radioactive waste, and the radiation sources at the facilities cannot explode nor in any other way release radioactivity into the environment. 3 refs.

08 HYDROGEN

0801 Production

Refer also to citation(s) 6969

0802 Storage, Transport, and Handling

6499 (BNL–46778) **Chemistry of intermetallic hydrides.** Reilly, J.J. Brookhaven National Lab., Upton, NY (United States). [1991]. 23p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-911047–9: 180. meeting of the Electrochemical Society, Phoenix, AZ (United States), 13-18 Oct 1991). Order Number DE92005000. Source: OSTI; NTIS; GPO Dep.

Certain intermetallic hydrides are safe, convenient and inexpensive hydrogen storage compounds. A particular advantage of such compounds is the ease with which their properties can be modified by small changes in alloy composition or preparation. This quality can be exploited to optimize their storage properties for particular applications, e.g. as intermetallic hydride electrodes in batteries. We will be concerned herein with the more important aspects of the thermodynamic and structural principles which regulate the behavior of intermetallic hydrogen systems and then illustrate their application using the archetype hydrides of LaNi5, FeTi and Mg alloys. The practical utility of these classes of materials will be briefly noted.

09 BIOMASS FUELS

0908 Production

6500 (CRIE-U–90054) **Development of technology for plantlet propagation by tissue culture. (3).: Strawberry callus growth and changes in pH in liquid medium.** Yoshihara, T. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)); Hanyo, H. Central Research Inst. of Electric Power Industry, Abiko, Chiba (Japan). Feb 1991. 27p. (In Japanese). Order Number DE92749206. Source: OSTI; NTIS (US Sales Only).

Development of strawberry cultivation plants is described as a part of night-time power utilization activities for power load levelling. Strawberry calluses (undifferent tissue mass) cultured in a liquid medium reach the fastest growth period in one week and the steady state in four weeks. The callus growth shows the maximum value at this time, which was 20 times as much of the seedling. The medium pH changed in a range from 4 to 7. If the initial pH is 4.0 or higher, no difference is created in the callus propagation in the steady state period, but at 3.0, no propagation whatsoever. The pH after the fastest growth period converged to a range from 6.0 to 7.0, with the exception of initial pH at 3.0. The medium pH decreased as a result of pre-culture heating sterilization, formation of iron phosphate due to light irradiation, and organic acid release during the initial growth phase. The pH increased because of difference in the speed of absorbing ammonium and nitric acid during the later growth phase. The growth efficiency of 20 times is about the same as other plants. Since the pH change is maintained within the range from 4 to 7, which causes no difference in in growth, there is no need of adjusting the pH within this range. 18 refs., 15 figs., 3 tabs.

0909 Processing

Refer also to citation(s) 6505, 6865

6501 (Juel–2457) **Interactive data analysis in biotechnical process data.** Wiechert, W. Forschungszentrum Juelich GmbH (Germany). Inst. fuer Biotechnologie; Bonn Univ. (Germany). Mar 1991. 409p. (In German). Order Number DE92759210. Source: OSTI; NTIS (US Sales Only).

The first section provides an introduction to the problems of biotechnical data analysis. Its aim is to give a preliminary understanding of an interactive data analysis system. The methods used are therefore first explained in an informal way. In the following sections the theoretical premises are systematically laid out and the methods precisely explained. (orig.).

6502 **Process of converting starch to glucose and glucose to lactic acid.** Tsai, TenLin; Sanville, C.Y.; Coleman, R.D.; Schertz, W.W. To Dept. of Energy. 1990. Filed date 4 Apr 1990. USA Patent patent application 7-504,223. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. Order Number DE92003840. Source: OSTI; NTIS; GPO Dep.

This document describes a method for converting starch into lactic acid of sufficient purity for use as a substrate for biodegradable plastics. The process is designed to work on industrial food waste streams such as potato wastes or cheese whey permeate. For potato waste, α-amylase and calcium chloride are added to the starch containing waste and incubated at a pH of 4–7, a temperature of 90–130°C, and a pressure above 15 psi for not less than 15 minutes. At this point, glucoamylase is added and the mixture is incubated at a temperature of 50–70°C and a pH below 6.5 for 4 hours. This results in the conversion of more than 90% of the starch into glucose, which is substantially free of microbial contamination. The hydrolysate is filtered, and introduced with additional nutrients to a fermentor containing a lactose producing microorganism to form a fermentation broth. This results in the fermentation of glucose to lactose, which is filtered and subjected to electrodialysis for purification. Conversion of glucose to lactic acid or lactate occurs with an efficiency of over 95%. 1 fig. (MHB)

6503 (PNL–7830-Vol.2) **Development of an extruder-feeder biomass direct liquefaction process: Volume 2, Parts 4–8: Final report.** White, D.H. (Arizona Univ., Tucson, AZ (United States). Dept. of Chemical Engineering); Wolf, D. Pacific Northwest Lab., Richland, WA (United States); Arizona Univ., Tucson, AZ (United States). Dept. of Chemical Engineering. Oct 1991. 244p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC06-76RL01830. Order Number DE92003844. Source: OSTI; NTIS; GPO Dep.

As an abundant, renewable, domestic energy resource, biomass could help the United States reduce its dependence on imported oil. Biomass is the only renewable energy technology capable of addressing the national need for liquid transportation fuels. Thus, there is an incentive to develop economic conversion processes for converting biomass, including wood, into liquid fuels. Through research sponsored by the US DOE's Biomass Thermochemical Conversion Program, the University of Arizona has developed a unique biomass direct liquefaction system. The system features a modified single-screw extruder capable of pumping solid slurries containing as high as 60 wt% wood flour in wood oil derived vacuum bottoms at pressures up to 3000 psi. The extruder-feeder has been integrated with a unique reactor by the University to form a system which offers potential for improving high pressure biomass direct liquefaction technology. The extruder-feeder acts simultaneously as both a feed preheater and a pumping device for injecting wood slurries into a high pressure reactor in the biomass liquefaction process. An experimental facility was constructed and following shakedown operations, wood crude oil was produced by mid-1985. By July 1988, a total of 57 experimental continuous biomass liquefaction runs were made using White Birch wood feedstock. Good operability was achieved at slurry feed rates up to 30 lb/hr, reactor pressures from 800 to 3000 psi and temperatures from 350°C to 430°C under conditions covering a range of carbon monoxide feed rates and sodium carbonate catalyst addition. Crude wood oils containing as little as 6–10 wt% residual oxygen were produced. 38 refs., 82 figs., 26 tabs.

6504 **Apparatus for continuously producing sawdust charcoal.** Suzuki, K. 9 Aug 1991. Filed date 9 Feb 1990. Canada Patent patent application 2009666. 12p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $4.00 CAN; MF $2.75 CAN.

An apparatus is provided for producing sawdust charcoal, in which cylindrical sawdust charcoal is produced from Ogalite, a solid fuel obtained by heating and compressing sawdust into a cylindrical shape. The apparatus comprises a heating cylinder provided with vent holes for heating the Ogalites, means for transferring the Ogalites within the heating cylinder at a predetermined speed, and a combustion kiln for burning gases exhausted through the vent holes to heat the heating cylinder. The heating cylinder may have a sectional shape such that a plurality of cylindrical Ogalites can be simultaneously inserted. Upon heating in this apparatus, the Ogalites are exothermically decomposed to be carbonized under reducing conditions. In a preferred embodiment, the transferring means consists of a feed screw with a drive motor which operates at such a speed that the Ogalites reside in the heating cylinder for about 30 minutes. The cylinder is provided with an ash hopper for stocking ashes at an end of the cylinder in order to prevent air from flowing into the cylinder. The sawdust charcoals produced in the apparatus of the invention are uniform in shape and quality, and are easily handled for transportation and storage. 2 figs.

0920 Combustion

Refer also to citation(s) 6862

0930 Economic, Industrial, and Business Aspects

6505 (ORNL/TM–11851) **Technoeconomic evaluation of the extractive fermentation of butanol as a guide to research in this area of biotechnology.** Busche, R.M. (Bio En-Gene-Er Associates, Inc., Wilmington, DE (United States)). Oak Ridge National Lab., TN (United States). Sep 1991. 292p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE92004588. Source: OSTI; NTIS; GPO Dep.

This report represents the completion of a part of an overall project to evaluate the technical and economic status of several newly conceptualized processes for producing butanol, acetone, acetic acid, and aerobically produced specialty chemicals, which are candidates for research support. The objective of the project are to identify strengths and weaknesses in the proposed and to assist in developing an ongoing research strategy along economically relevant lines. The products to be studied presently comprise a collective US market for 10.7 billion lb valued at $2.8 billion. If their manufacturing processes were converted from petroleum feedstocks to corn, they could consume 556 million bushels. Furthermore, if ethanol could be produced at a low enough price to serve as the precursor to ethylene and butadiene, it an its derivatives could account for 159 billion lb, or 50% of the US production of 316 billion lb of synthetic organic chemicals, presently valued at $113 billion. This use would consume 3.4 billion bushels, or ~45% of the corn crop. In addition, the use of butanol for diesel blends or in jet fuel blends to enhance the range of military aircraft could further increase its market.

10 SYNTHETIC FUELS

1002 Production

Refer also to citation(s) 6138, 6140, 6144, 6150, 6161, 6174, 6185

6506 (CONF-9106303–, pp. 109-110) **A novel process for methanol synthesis.** Tierney, J.W. (Univ. of Pittsburgh, PA (United States)); Wender, I. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-89PC89786. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

A novel slurry phase synthesis of methanol under mild conditions of 110-150C and 40-65 atm is being investigated. The synthesis involves the carbonylation of a molecule of methanol to methyl formate predominantly in the liquid phase followed by the heterogeneous hydrogenolysis of methyl formate to two molecules of methanol; the net result is the reaction of H_2 with CO to give methanol. A number of catalyst systems have been found to be active; a mixed catalyst comprised of KOMe/Cu-chromite was the most active. The system tolerates small amounts of CO_2 and H_2O and can give up to 90% conversion with 95% selectivity to methanol. The nature of the catalyst and the reactions involved, possible effects of alkali loading, interaction between catalysts and different species will be discussed.

13 HYDRO ENERGY

6507 (DOE/ID–10237(90-91)) **DOE Hydropower Program biennial report 1990–1991 (with updated annotated bibliography).** Chappell, J.R. (Idaho National Engineering Lab., Idaho Falls, ID (United States)); Rinehart, B.N.; Sommers, G.L.; Sale, M.J. Department of Energy, Idaho Falls, ID (United States). Idaho Operations Office. Jul 1991. 62p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC07-76ID01570. (MISC–89083). Order Number DE92003316. Source: OSTI; NTIS; GPO Dep.

This report summarizes the activities of the US Department of Energy's (DOE) Hydropower Program for fiscal years 1990 and 1991, and provides an annotated bibliography of research, engineering, operations, regulations, and costs of projects pertinent to hydropower development. The Hydropower Program is organized as follows: background (including Technology Development and Engineering Research and Development); Resource Assessment; National Energy Strategy; Technology Transfer; Environmental Research; and, the bibliography discusses reports written by both private and non-Federal Government sectors. Most reports are available from the National Technical Information Service. 5 figs., 2 tabs.

1305 Economic, Industrial and Business Aspects

Refer also to citation(s) 6823

1306 Environmental Aspects

6508 (DOE/BP/39339–5) **Assessment of the fishery improvement opportunities on the Pend Oreille River: Appendices: Annual report, 1990.** Ashe, B.L.; Lillengreen, K.L.; Vella, J.J.; Clark, L.O.; Nenema, G.J. Jr.; Richards, D.L.; Skillingstad, T.H.; Scholz, A.T. Eastern Washington Univ., Cheney, WA (United States). Upper Columbia United Tribes Fisheries Center. Mar 1991. 338p. Sponsored by U.S. DOE Bonneville Power Administration. DOE Contract BI79-88BP39339. Order Number DE92005362. Source: OSTI; NTIS; GPO Dep.

This report is a compilation of the seven appendices to DOE/BP/39339–4 the annual report for FY 1990. These appendices contain the supporting numerical data for the study. The purpose of this study was to assess the fishery improvement opportunities on the Box Canyon portion of the Pend Oreilla River. This three year study was initiated as part of the Northwest Power Planning Council's 1987 Columbia River Basin Fish and Wildlife Program. This report contains the findings of the third and final year of the study. The objectives of the third year of the study were to determine the relative abundance of each species in the river and sloughs; the population levels in five selected tributaries and, if possible, for fish in the river and sloughs; each species growth rate, feeding habits, abundance of preferred prey, and migration patterns; and the seasonal movement patterns and habitat utilization of largemouth bass.

6509 (DOE/BP/63584–5, pp. 6-44) **Life history and population dynamics of subadult and adult white sturgeon in the Columbia River between Bonneville and McNary dams.** Oregon Dept. of Fish and Wildlife, Portland, OR (United States). Sep 1991. Sponsored by U.S. DOE Bonneville Power Administration. In *Status and habitat requirements of the white sturgeon populations in the Columbia River downstream from McNary Dam: Annual progress report, April 1990–March 1991.* 180p. Order Number DE92005343. Source: OSTI; NTIS.

We report on our effort from April 1990 to March 1991 to describe the life history and population dynamics of white sturgeon Acipenser transmontanus in John Day Reservoir. We set 1,188 set lines and 26 gill nets. We caught 623 white sturgeon with set lines an 236 with gill nets. Catch per unit effort was much higher in areas near the tailrace than in downstream sites. Our setlines were size selective. We recaptured 3 fish released in John Day Reservoir in 1989 and 28 fish released in 1990. Sport and commercial fishermen recovered 62 tags from fish we tagged in Bonneville, The Dalles and John Day reservoirs, 1987–1990. We observed extensive movements of marked sturgeon within the reservoirs. We completed aging of available samples from all three reservoirs from 1987–1990. We aged fish as old as 46 years. Bone marks were observed on 74 of 78 fish previously injected with oxytetracycline and annulus formation was generally complete after June. We estimated parameters in a length-weight equation. About 1.5% of the female white sturgeon we examined to date had early or late vitellogenic eggs and would be expected to spawn the following year. 5 refs., 4 figs., 24 tabs.

6510 (DOE/BP/63584–5, pp. 45-81) **Reproduction and early life history characteristics of white sturgeon populations in Columbia River downstream from Bonneville Dam.** Oregon Dept. of Fish and Wildlife, Portland, OR (United States). Sep 1991. Sponsored by U.S. DOE Bonneville Power Administration. In *Status and habitat requirements of the white sturgeon populations in the Columbia River downstream from McNary Dam: Annual progress report, April 1990–March 1991.* 180p. Order Number DE92005343. Source: OSTI; NTIS.

The Washington Department of fisheries (WDF) censused the recreational fisheries in Bonneville and John Day reservoirs for mark recovery, biological samples and harvest data on white sturgeon (Acipenser transmontanus). Samplers interviewed 4,854 anglers in Bonneville Reservoir from March through October 1990 and 4, 952 anglers in John Day Reservoir from March through October 1990. Harvest estimates of legal size white sturgeon for these time periods were 2,114 in Bonneville Reservoir and 316 in John Day reservoir. Biological sampling was conducted on 12% of the Bonneville Reservoir sturgeon harvest and 16% of the sturgeon harvest in John Day reservoir during respective census periods. Treaty commercial fishery landings were sampled for harvest, mark and biological information on white sturgeon. WDF assisted the National Marine Fisheries Services in assessing reproduction and early life history of white sturgeon downstream from Bonneville Dam. WDF processed and staged samples of eggs and larvae collected in 1990. Population dynamics modeling o white sturgeon downstream from Bonneville Dam in 1990 included refinement of abundance and exploitation estimates and reproductive parameters. A total of 3,364 white sturgeon were tagged. Age validation techniques were furthered by injecting OTC and secondarily marking 962 white sturgeon. There were 14 recoveries of OTC-injected sturgeon from 1989 tagging efforts. Fecundity, age and other biological parameters were gathered on oversized sturgeon (>183 cm TL) by monitoring wild broodstock capture activities by Oregon private aquaculturists in 1990. Data were collected on 36 sturgeon including 24 that were oversized. 8 refs., 8 figs., 13 tabs.

6511 (DOE/BP/63584–5, pp. 82-144) **Habitat requirements for spawning and rearing of white sturgeon and quantify the extent of habitat available in the Columbia River between Bonneville and McNary dams.** Oregon Dept. of Fish and Wildlife, Portland, OR (United States). Sep 1991. Sponsored by U.S. DOE Bonneville Power Administration. In *Status and habitat requirements of the white sturgeon populations in the Columbia River downstream from McNary Dam: Annual progress report, April 1990–March 1991.* 180p. Order Number DE92005343. Source: OSTI; NTIS.

The US Fish and Wildlife Service (FWS) sampled white sturgeon (Acipenser transmontanus) eggs, larvae, and juveniles in the three Columbia River pools between Bonneville (RM 146.5) and McNary (RM 292. 0) dams from April through October, 1990. White sturgeon spawned in the tailrace areas in each pool at water temperatures of 12.9 to 17. 9°C, and mean water column velocities of 0.4 to 2.3 m per second. Based on back-calculated egg age, white sturgeon spawning occurred from 23 May to 7 July in Bonneville Pool, from 4 June to 2 July in The Dalles Pool, and from 27 May to 12 June in John Day Pool. Seven-hundred and sixty-eight white sturgeon eggs were collected in Bonneville Pool, compared with 337 in the Dalles Pool, and 71 in John Day Pool. Twenty-one percent of the eggs collected in Bonneville Pool were non-viable (dead or fungused) compared with 57% in The Dalles Pool, and 7% in John Day Pool. Three to four times as many larval white sturgeon were collected in bonneville Pool (221) than in The Dalles Pool (66) or John Day Pool (80). Young-of-the-year (YOY) white sturgeon collected in Bonneville Pool accounted for nearly 95% of the 1990 total annual catch of YOY from all three pools combined. Young- of-the-year white sturgeon were collected in all pools at 19.5 to 48. 8 m depths, over sand, mud, gravel, and cobble substrates. For the first time in this study, which began in 1987, YOY white sturgeon were collected in the Dalles Pool. Five YOY were collected in The Dalles Pool, while no YOY were collected in John Day Pool. Nearly 92% of all juvenile white sturgeon collected were caught in Bonneville Pool; juvenile catch per hectare was substantially higher in Bonneville Pool (3.84) than in the Dalles (0.92) and John Day pools (0.16). Juvenile white sturgeon were collected from water depths ranging from 9.1 to 36.0 m over substrates ranging from silt to cobble. 19 refs., 12 figs., 2 tabs.

6512 (DOE/BP/63584–5, pp. 145-180) **Habitat requirements for spawning and rearing of white sturgeon and quantification of extent rearing of habitat available in the Columbia River downstream from Bonneville Dam.** Oregon Dept. of Fish and Wildlife, Portland, OR (United States). Sep 1991. Sponsored by U.S. DOE Bonneville Power Administration. In *Status and habitat requirements of the white sturgeon populations in the Columbia River downstream from McNary Dam: Annual progress report, April 1990–March 1991.* 180p. Order Number DE92005343. Source: OSTI; NTIS.

During 1990, the National Marine Fisheries Service (NMFS) sampled white sturgeon Acipenser transmontanus eggs, larvae and juveniles in the Columbia River downstream from Bonneville Dam (River Mile (RM) 145). In conjunction with the Washington Department of Fisheries, 2,785 white sturgeon eggs were collected with plankton nets and artificial substrates between RMs 120 and 145; virtually all the eggs were collected within 6 miles of Bonneville Dam. In 1990, a total of 1,409 juvenile white sturgeon were collected with trawls, primarily a 7.9-m (headrope length) semiballoon shrimp trawl, in the Columbia River downstream from Bonneville Dam. Distributions of juvenile sturgeon were patchy; not only were there differences in catches among different areas of the river, but also differences in catches among parallel transects within the same area. The mean density of juvenile white sturgeon was highest at water depths (maximum) $\geq$18.3 m (45 ± 126 (mean ± SD) sturgeon/hectare) and lowest and depths $<$9.1 m (1 ± 3 sturgeon/hectare). In 1990, a total of 273 young-of-the-year white sturgeon were collected between RMs 28 and 131. Young-of-the-year preferred deeper areas of the river (mean minimum and maximum depths were 12.5 and 21.1 m, respectively). Since the white sturgeon is a demersal species and eats benthic invertebrates, four benthic surveys were conducted at RMs 95 and 131–132 in conjunction with the juvenile sampling to provide information on interannual variability of invertebrate populations. In addition, benthic samples were collected at six newly established shallow-water stations at RMs 95 and 131–132 to determine if densities of benthic invertebrates, particularly Corophium salmonis (an important prey for juvenile sturgeon), were high in these areas. Densities of C. salmonis in shallow water at RM 95 frequently exceeded 1,200 organisms/m^2, whereas in shallow water at RM 131–132, densities generally did not exceed 76 organisms/m^2.

1307 Power-Conversion Systems

6513 **From the power of water comes energies.** Sheu, B.; Sheu, T.; Sheu, S. 5 Aug 1991. Filed date 5 Feb 1990. Canada Patent patent application 2009261. 14p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $4.00 CAN; MF $2.75 CAN.

Arrangements are provided to convert hydraulic water power to intense air flows which are then used to power air turbines for electricity generation. In one embodiment, water from a nozzle enters a chamber through a cylinder where the water extracts a great volume of air at a very high speed, thus producing a jet of air in an outlet pipe which drives the air turbine. The chamber also has a means to regulate the flow of water from the water outlet control valve. In another embodiment, water is fed through a spiral orifice that has a counterclockwise spiral spring attached on its pipe shaft. The water coming out of the orifice has a high speed of orbital angular momentum with a strong vacuum power which is used to drive the air turbine located in front of the orifice opening. A cylinder enclosing the turbine provides a means by which to direct the flow of water and to recover more energy from the orifice. 4 figs.

14 SOLAR ENERGY

1401 Resources and Availability

Refer also to citation(s) 6532

6514 (DLR-FB–91-06) **Anisotropic reflection in mountainous terrain to determine the absorption of solar radiation from satellite data.** Ruppersberg, G.H. (DLR, Inst. fuer Physik der Atmosphaere, Oberpfaffenhofen (Germany)); Buell, R.H. Deutsche Forschungsanstalt fuer Luft- und Raumfahrt e.V. (DLR), Koeln (Germany). 1991. 40p. (In German). Order Number DE92759011. Source: OSTI; NTIS (US Sales Only).

The anisotropic factors of quasi-3-dimensionally modelled areas in the Alps - extent of the areas about (60x60) km^2 - are calculated for two wavelengths in the solar spectral region. For small snow cover absorptance and radiation budget are fairly approximated using simple assumptions for the reflectance function of the areas' elements. When the snow cover is increased large errors can arise, however, if reflectance anisotropy of the snow fields is not considered adequately. Actually, with METEOSAT measurements anisotropic factors f are needed that take this effect into consideration. In contrast, fairly accurate absorptances already are obtained with NOAA-AVHRR data and the assumption f=1 if evaluations are restricted to midday overpasses and positions of the area in the region of nadir ± 273 km. (orig.) With 16 figs., 3 tabs., 20 refs.

1403 Economic, Industrial, and Business Aspects

Refer also to citation(s) 6532, 6535

6515 (IAEA-TECDOC–624, pp. 425-446) **Solar photovoltaic electric technology.** Szeless, A. (Oesterreichische Elektrizitaetswirtschafts AG, Vienna (Austria)). International Atomic Energy Agency, Vienna (Austria). Sep 1991. (CONF-910506–: Senior expert symposium on electricity and the environment, Helsinki (Finland), 13-17 May 1991). In *Electricity and the environment: Background papers for a senior expert symposium held in Helsinki, 13-17 May 1991.* 600p. Order Number DE92607903. Source: OSTI; NTIS (US Sales Only); INIS.

This paper describes the status and outlook of different solar photovoltaic power generation technologies and resources. Technical characteristics of solar photovoltaic systems are discussed. Also treated are environmental impacts and costs of solar photovoltaic generating technology which are expected to be available between now and the year 2020. Some institutional and other barriers are pointed out which might delay the deployment of solar photovoltaic power generating systems. Finally, recommendations of technology development priorities and the need and opportunities for international cooperation is stressed. (author). 26 refs, 2 figs, 3 tabs.

6516 (NREL/TP–214-4569) **Photovoltaic manufacturing technology, Phase 1: Final subcontract report, 9 January 1991–14 April 1991.** Albright, S. (Photon Energy, Inc., El Paso, TX (United States)). National Renewable Energy Lab., Golden, CO (United States); Photon Energy, Inc., El Paso, TX (United States). Nov 1991. 13p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE91015032. Source: OSTI; NTIS; GPO Dep.

This report summarizes the analysis of photovoltaic module manufacturing done by Photon Energy, Inc. Photon Energy's four-stage expansion plan for photovoltaic module manufacturing is explained. Explored and studied were the following: current capabilities in manufacturing and process development, potential for increasing production and reducing manufacturing costs, problems likely to impede increased production and reduced manufacturing costs, and costs and other requirements involved in overcoming problems in manufacturing technology.

6517 (SAND–91-2408C) **Photovoltaics as a worldwide energy option: A case study in development strategy.** Jones, G.; Pate, R.; Hill, R. Sandia National Labs., Albuquerque, NM (United States). [1991]. 14p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789. (CONF-9110299–1: 1991 Asia energy conference, Bangkok (Thailand), 17-20 Oct 1991). Order Number DE92004733. Source: OSTI; NTIS; INIS; GPO Dep.

Renewable energy technologies, such as solar thermal electric, photovoltaics (PV), and wind energy have made significant gains in cost and performance in the past decades. As a result, there have been high expectations on the part of the public for these sources to play a major role in future energy supply, especially as environmental concerns about conventional sources increase. Despite these past gains and high expectations, the global potential of renewable energy technologies still remains largely untapped, principally because of issues of industrialization and user acceptance. There is increasing recognition that government energy programs must incorporate a broader strategy than the traditional basic research role if they are to address these issues. Essential elements of this strategy are affordable technology, a healthy industry, sustained market growth, user acceptance, and equitable policy and financial environments. The US Department of Energy (DOE) programs in solar electric conversion have already started the development of the required broader-based effort. This paper presents the status of that work, utilizing the US National Photovoltaic Program as a case study.

6518 (SAND–91-2599C) **Photovoltaics as a worldwide energy source.** Jones, G.J. Sandia National Labs., Albuquerque, NM (United States). [1991]. 8p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789. (CONF-920227–1: 6. international photovoltaic science and engineering conference, New Delhi (India), 10-14 Feb 1992). Order Number DE92004735. Source: OSTI; NTIS; INIS; GPO Dep.

Photovoltaic energy systems have historically been treated as a bulk power generation source for the future. However, utilities and other agencies involved with electrification throughout the world are beginning to find photovoltaics a least-cost option to meet specific loads both for themselves and their customers, in both off-grid and grid-connected applications. These expanding markets offer the potential of hundreds of megawatts of sales in the coming decade, but a strategy addressing both industrial growth and user acceptance is necessary to capitalize on this opportunity. 11 refs.

6519 (SAND–91-7014) **Barriers to commercialization of large-scale solar electricity: Lessions learned from the LUZ experience.** Lotker, M. (Lotker (Michael), Westlake Village, CA (United States)). Sandia National Labs., Albuquerque, NM (United States). Nov 1991. 47p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789. Order Number DE92004851. Source: OSTI; NTIS; GPO Dep.

This report discusses the economic and policy factors leading to the initial successful introduction of Luz International Limited's Solar Electric Generating Systems (SEGS). It then addresses the wide range of barriers to continued SEGS commercialization, including state and federal tax policy, avoided cost energy pricing, artificial size limitations under the Public Utility Regulatory Policies Act (PURPA), the loss of effectiveness of PURPA itself, the lack of incentives available to utilities as owners of solar electric plants, and the limited ways in which the environmental benefits of this technology have been recognized. The way in which each of these barriers contributed to the suspension of new LUZ projects is highlighted. In addition, mitigation approaches to each of these barriers are suggested.

1405 Solar Energy Conversion

Refer also to citation(s) 6516, 6517, 6997

6520 (NREL/TP–214-4459) **SERI photovoltaic subcontract reports: Abstracts and document control information, January 1–July 31, 1991.** National Renewable Energy Lab., Golden, CO (United States). Oct 1991. 15p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE91015005. Source: OSTI; NTIS; GPO Dep.

This report contains the document control information and abstracts for SERI Photovoltaic (PV) Program publications resulting from SERI's subcontracted PV research. The information is presented for reports published or distributed from January 1 through July 31, 1991. This report will outline these publications, organized by technology, on a regular basis. A list of additional publications and sources is included herein to provide the photovoltaic community with other sources of information. All of the documents represented here are available from the National Technical Information Service.

6521 (NREL/TP–214-4468) **Role of polycrystallinity in CdTe and CuInSe$_2$ photovoltaic cells: Annual subcontract report, 1 April 1990–31 March 1991.** Sites, J.R. (Colorado State Univ., Fort Collins, CO (United States)). National Renewable Energy Lab., Golden, CO (United States); Colorado State Univ., Fort Collins, CO (United States). [1991]. 23p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE92001168. Source: OSTI; NTIS; GPO Dep.

The polycrystalline nature of thin-film CdTe and CuInSe$_2$ solar cells continues to be a major factor in several individual losses that limit overall cell efficiency. This report describes progress in the quantitative separation of these losses, including both measurement and analysis procedures. It also applies these techniques to several individual cells to help document the overall progress with CdTe and CuInSe$_2$ cells. Notably, CdTe cells from Photon Energy have reduced window photocurrent losses to 1 mA/Cm^2; those from the University of South Florida have achieved a maximum power voltage of 693 mV; and CuInSe$_2$ cells from International Solar Electric Technology have shown a hole density as high as 7×10^{16} cm^{-3}, implying a significant reduction in compensation. 9 refs.

6522 (NREL/TP–214-4480) **Photovoltaic manufacturing technology, Phase 1: Final subcontract report, 9 January 1991–14 April 1991.** Somberg, H. (Global Photovoltaic Specialists, Inc., Canoga Park, CA (United States)). National Renewable Energy Lab., Golden, CO (United States); Global Photovoltaic Specialists, Inc., Canoga Park, CA (United States). Nov 1991. 30p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE92001152. Source: OSTI; NTIS; GPO Dep.

This report describes existing integrated processes for solar cell manufacturing and lists as the primary opportunity for improvement the following areas: low-cost silicon sheets with improved characteristics; improved large-scale and automated solar cell processes that can lead to cell efficiencies in the range of 14% (encapsulated) for direct-cast wafers; improved handling and lamination of large-area modules for the emerging utility market. The proposed solutions can lead to finished module costs on the order of $1.55 per square meter or a selling price of less than $2.00/Watt. The problems that may be considered generic to the industry and that have been addressed in this work are as follows: gettering and passivation of silicon wafers; spray-on passivation layers; dual antireflection coatings; ink-jet printing of metallizations; and automated handling of large-area modules and associated vertical lamination. 14 refs.

6523 (NREL/TP–214-4489) **Photovoltaic manufacturing technology, Phase 1: Final subcontract report, 9 January 1991–14 April 1991.** Brown, S. (Glasstech Solar, Inc., Golden, CO (United States)); Shen, D.S.; Heeke, N. National Renewable Energy Lab., Golden, CO (United States); Glasstech Solar, Inc., Golden, CO (United States). Nov 1991. 61p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE91015025. Source: OSTI; NTIS; GPO Dep.

This report describes the Glasstech Solar design concepts for improved thin-film module production, including three process steps: (1) The front-end step includes washing, transparent conductive oxide (TCO) deposition, and patterning. (2) The P-I-N-M step is that in which the photovoltaic cell structure is deposited, including the back contact, without breaking vacuum. (3) The back end step includes masking, etching, washing, subcell testing and repair, interconnection, and encapsulation. The design is flexible and can be configured to a variety of applications. The front and back sections (steps 1 and 3) include a number of rotate modules and spacer conveyors. These modules and conveyors enable the line to hold and release glass panels according to the requirements of the process stations. 2 refs., 13 figs.

6524 (NREL/TP–214-4498) **Improved techniques for manufacturing the Alpha Solarco concentrating photovoltaic system: Final subcontract report, 9 January 1991–14 April 1991.** Schmidt, E. (Alpha Solarco, Inc., Cincinnati, OH (United States)). National Renewable Energy Lab., Golden, CO (United States); Alpha Solarco, Inc., Cincinnati, OH (United States). Nov 1991. 31p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE91015029. Source: OSTI; NTIS; GPO Dep.

This report describes the overall procedure involved in the manufacture of photovoltaic cells and modules; identified and describes potential cell and module manufacturing processes that can lead to improved performance, reduced manufacturing costs and significantly increased production, and notes the long-range potential benefits of these improvements; identifies and describes any problems that may impede the achievement of the long-range benefits; and identifies and describes the approaches for solving the identified implementation problems, including time and cost estimates.

6525 (NREL/TP–214-4502) **Polycrystalline thin film materials and devices: Annual subcontract report, 16 January 1990–15 January 1991.** Baron, B.N. (Delaware Univ., Newark, DE (United States). Inst. of Energy Conversion); Birkmire, R.W.; Phillips, J.E.; Shafarman, W.N.; Hegedus, S.S.; McCandless, B.E. National Renewable Energy Lab., Golden, CO (United States); Delaware Univ., Newark, DE (United States). Inst. of Energy Conversion. Nov 1991. 65p. Sponsored by U.S. DOE Conservation &

Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE92001171. Source: OSTI; NTIS; GPO Dep.

Results and conclusion of Phase I of a multi-year research program on polycrystalline thin film solar cells are presented. The research comprised investigation of the relationships among processing, materials properties and device performance of both $CuInSe_2$ and CdTe solar cells. The kinetics of the formation of $CuInSe_2$ by selenization with hydrogen selenide was investigated and a $CuInSe_2$/CdS solar cell was fabricated. An alternative process involving the reaction of deposited copper-indium-selenium layers was used to obtain single phase $CuInSe_2$ films and a cell efficiency of 7%. Detailed investigations of the open circuit voltage of $CuInSe_2$ solar cells showed that a simple Shockley-Read-Hall recombination mechanism can not account for the limitations in open circuit voltage. Examination of the influence of $CuInSe_2$ thickness on cell performance indicated that the back contact behavior has a significant effect when the $CuInSe_2$ is less than 1 micron thick. CdTe/CdS solar cells with efficiencies approaching 10% can be repeatedly fabricated using physical vapor deposition and serial post deposition processing. The absence of moisture during post deposition was found to be critical. Improvements in short circuit current of CdTe solar cells to levels approaching 25 mA/cm^2 are achievable by making the CdS window layer thinner. Further reductions in the CdS window layer thickness are presently limited by interdiffusion between the CdS and the CdTe. CdTe/CdS cells stored without protection from the atmosphere were found to degrade. The degradation was attributed to the metal contact. CdTe cells with ZnTe:Cu contacts to the CdTe were found to be more stable than cells with metal contacts. Analysis of current-voltage and spectral response of CdTe/CdS cells indicates the cell operates as a p-n heterojunction with the diode current dominated by SRH recombination in the junction region of the CdTe.

6526 (NREL/TP-214-4503) **The effectiveness and stability of impurity/defect interactions and their impact on minority carrier lifetime: Annual subcontract report, 1 August 1990–31 July 1991.** Rozgonyi, G.A. (North Carolina State Univ., Raleigh, NC (United States)); Shimura, F.; Buczkowski, A.; Zhon, T.Q. National Renewable Energy Lab., Golden, CO (United States); North Carolina State Univ., Raleigh, NC (United States). Dec 1991. 58p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE92001172. Source: OSTI; NTIS; GPO Dep.

This report covers the investigation and understanding of electrical activity of "clean" and metallic impurity decorated defects. A heterostructure containing a controlled number of deliberately introduced misfit dislocations is used as a model system to simulate a variety of defect/impurity interactions in photovoltaic materials. In addition, a noncontact laser/microwave deep-level transient spectroscopy technique is applied to characterize the minority carrier lifetime and determine the energy levels of defects. 59 refs.

6527 (NREL/TP-214-4610) **Polycrystalline thin-film solar cells and modules.** Ullal, H.S.; Stone, J.L.; Zweibel, K.; Surek, T.; Mitchell, R.L. National Renewable Energy Lab., Golden, CO (United States). Dec 1991. 7p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. (CONF-920227-3: 6. international photovoltaic science and engineering conference, New Delhi (India), 10-14 Feb 1992). Order Number DE92001196. Source: OSTI; NTIS; GPO Dep.

This paper describes the recent technological advances in polycrystalline thin-film solar cells and modules. Three thin film materials, namely, cadmium telluride (CdTe), copper indium diselenide ($CuInSe_2$, CIS) and silicon films (Si-films) have made substantial technical progress, both in device and module performance. Early stability results for modules tested outdoors by various groups worldwide are also encouraging. The major global players actively involved in the development of the these technologies are discussed. Technical issues related to these materials are elucidated. Three 20-kW polycrystalline thin-film demonstration photovoltaic (PV) systems are expected to be installed in Davis, CA in 1992 as part of the Photovoltaics for Utility-Scale Applications (PVUSA) project. This is a joint project between the US Department of Energy (DOE), Pacific Gas and Electric (PG&E), Electric Power Research Institute (EPRI), California Energy Commission (CEC), and a utility consortium.

6528 **Method of making semiconductor junctions.** James, R.B. To Dept. of Energy. 1990. Filed date 13 Jun 1990. USA Patent patent application 7-537,957. 28p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC04-76DR00789. Order Number DE92003686. Source: OSTI; NTIS; GPO Dep.

A p-n junction on a silicon substrate doped with boron ions (d-dopant) is made in following manner. A shallow silicon surface layer including a n-type dopant is first obtained by ion implantation of the substrate with arsenic atoms. The arsenic-doped silicon layer at the surface has a relatively low initial reflectivity. Then, radiation from a pulsed carbon dioxide laser is directed onto the doped surface. A portion of the pulsed radiation causes melting of the thin arsenic-doped layer at the solid surface, giving the shallow melted surface a reflectivity greater than the initial reflectivity of the solid surface. The increased reflectivity of the melted surface prevents an additional portion of the pulsed radiation from causing further melting, thus controlling the depth of melting. The melted surface is then allowed to cool and solidify to form a p-n junction at a thin (less than 200 angstrom) junction depth. 6 figs.

6529 (PTB-Opt-31) **The results of the PEP '87 round robin calibration of reference solar cells and modules. Final report.** Metzdorf, J.; Wittchen, T.; Heidler, K.; Dehne, K.; Shimokawa, R.; Nagamine, F.; Ossenbrink, H.; Fornarini, L.; Goodbody, C.; Davies, M.; Emery, K.; DeBlasio, R. Physikalisch-Technische Bundesanstalt, Braunschweig (Germany). Abt. Optik. Nov 1990. 164p. Order Number DE92758945. Source: OSTI; NTIS (US Sales Only).

Initiated by the Photovoltaic Solar Energy Project (PEP) of the Technology, Growth and Employment Working Group of the Summit, a second international intercomparison (PEP'87 Round-Robin Calibration) on the calibration of reference solar cells and PV modules was carried out from 1987 to 1989 where PTB and ISE (FRG) served as operating agents. This report documents the final results of this intercomparison. A summary of this report was presented at the 21st IEEE Photovoltaic Specialists Conference. The round robin was required for two reasons: First, the dispersion of the results (definition, see Section 1.4) of the eight participants of the first PEP Round Robin 1984/85 where greater than expected with 2 σ_{rel} values of 5.6% and 12.2% for crystalline and amorphous Si reference cells, respectively. Second, a comparative study of calibration methods and of reference cell design and technology is required for the standardization of calibration methods and reference devices desired by the International Electrotechnical Commission (IEC TC82). Also more experience in the calibration is needed. (orig.).

6530 (SAND-91-2515C) **Process development for high-efficiency silicon solar cells.** Gee, J.M.; Basore, P.A.; Buck, M.E.; Ruby, D.S.; Schubert, W.K.; Silva, B.L.; Tingley, J.W. Sandia National Labs., Albuquerque, NM (United States). [1991]. 8p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789. (CONF-920227-2: 6. international photovoltaic science and engineering conference, New Delhi (India), 10-14 Feb 1992). Order Number DE92004741. Source: OSTI; NTIS; GPO Dep.

Fabrication of high-efficiency silicon solar cells in an industrial environment requires a different optimization than in a laboratory environment. Strategies are presented for process development of high-efficiency silicon solar cells, with a goal of simplifying technology transfer into an industrial setting. The strategies emphasize the use of statistical experimental design for process optimization, and the use of baseline processes and cells for process monitoring and quality control. 8 refs.

6531 (SAND-91-7013) **Modelling and fabrication of high-efficiency silicon solar cells.** Rohatgi, A. (Georgia Inst. of Tech., Atlanta, GA (United States). School of Electrical Engineering); Smith, A.W.; Salami, J. Sandia National Labs., Albuquerque, NM (United States); Georgia Inst. of Tech., Atlanta, GA (United States). School of Electrical Engineering. Oct 1991. 176p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789. Order Number DE92004781. Source: OSTI; NTIS; GPO Dep.

This report covers the research conducted on modelling and development of high-efficiency silicon solar cells during the period May 1989 to August 1990. First, considerable effort was devoted toward developing a ray-tracing program for the photovoltaic community to quantify and optimize surface texturing for solar cells. Second, attempts were made to develop a hydrodynamic model for device simulation. Such a model is somewhat slower than drift-diffusion type models like PC-1D, but it can account for more physical phenomena in the device, such as hot carrier effects, temperature gradients, thermal diffusion, and lattice heat flow. In addition, Fermi-Dirac statistics have been incorporated into the model to deal with heavy doping effects more accurately. Third and final component of the research includes development of silicon cell fabrication capabilities and fabrication of high-efficiency silicon cells. 84 refs., 46 figs., 10 tabs.

1406 Photovoltaic Power Systems

Refer also to citation(s) 6517, 6518, 6519, 6527

6532 (SAND–91-2211C) **The Alaska Energy Authority PV-Diesel hybrid assessment and design program.** Durand, S.J. (New Mexico State Univ., Las Cruces, NM (United States). Southwest Technology Development Inst.); Bower, W.; Chapman, R.; Smith, G. Sandia National Labs., Albuquerque, NM (United States). [1991]. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-911055–10: 22. IEEE photovoltaic specialists conference, Las Vegas, NV (United States), 7-11 Oct 1991). Order Number DE92004734. Source: OSTI; NTIS; INIS; GPO Dep.

Photovoltaic (PV) systems are increasing in popularity in the northern latitudes and in the arctic regions in the state of Alaska. This increased interest and the high cost of providing electric power in these remote areas have prompted the Alaska Energy Authority (AEA) to request assistance from the Photovoltaic Design Assistance Center at Sandia National Laboratories. A project to investigate the feasibility of using PV-Diesel hybrid power systems in small villages in Alaska was started in 1989. Data acquisition systems (DAS) were designed and installed in selected villages to obtain resource and load information. The DAS is described and village electrical and resource data are presented. Simulations were run using the collected village data and actual cost data provided by the AEA. Results of the simulations and the economic analysis are presented. 5 refs., 8 figs.

1407 Solar Thermal Power Systems

6533 (SAND–90-1162) **Characteristics, finite element analysis, test description, and preliminary test results of the STM4-120 kinematic Stirling engine.** Linker, K.L.; Rawlinson, K.S.; Smith, G. Sandia National Labs., Albuquerque, NM (United States). Oct 1991. 50p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789. Order Number DE92004784. Source: OSTI; NTIS; GPO Dep.

The Department of Energy's Solar Thermal Program has as one of its program elements the development and evaluation of conversion device technologies applicable to dish-electric systems. The primary research and development combines a conversion device (heat engine), solar receiver, and generator mounted at the focus of a parabolic dish concentrator. The Stirling-cycle heat engine was identified as the conversion device for dish-electric with the most potential for meeting the program's goals for efficiency, reliability, and installed cost. To advance the technology toward commercialization, Sandia National Laboratories has acquired a Stirling Thermal Motors, Inc., kinematic Stirling engine, STM4-120, for evaluation. The engine is being bench-tested at Sandia's Engine Test Facility and will be combined later with a solar receiver for on-sun evaluation. This report presents the engine characteristics, finite element analyses of critical engine components, test system layout, instrumentation, and preliminary performance results from the bench test.

6534 (SAND–90-2624) **Static load testing of a heliostat drive.** Grossman, J.W. Sandia National Labs., Albuquerque, NM (United States). Oct 1991. 60p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789. Order Number DE92003952. Source: OSTI; NTIS; GPO Dep.

The drive designed and built by the Solar Power Engineering Company (SPECO) for its large area heliostat failed under high wind loads during a winter storm. This report details the testing and analysis done to verify the load capabilities of the rebuilt heliostat drive. Changes in design and improvements in fabrication resulted in a usable drive. 12 figs., 7 tabs.

1408 Ocean Energy Systems

6535 (IAEA-TECDOC–624, pp. 267-274) **Ocean thermal energy conversion.** Cavanagh, J. (UKAEA Harwell Lab. (United Kingdom). Energy Technology Support Unit). International Atomic Energy Agency, Vienna (Austria). Sep 1991. (CONF-910506–: Senior expert symposium on electricity and the environment, Helsinki (Finland), 13-17 May 1991). In *Electricity and the environment: Background papers for a senior expert symposium held in Helsinki, 13-17 May 1991.* 600p. Order Number DE92607903. Source: OSTI; NTIS (US Sales Only); INIS.

Ocean Thermal Energy Conversion (OTEC) systems utilize the natural temperature difference that exists between the warm waters of the ocean surface and the colder waters of the deep ocean to drive a power plant. This temperature difference, caused by the heating effect of the sun, exists 24 hours a day allowing OTEC plants to operate continuously. It is generally considered that a temperature difference of the order of 20 deg. C would be required for the economic operation of an OTEC plant and this may be found in the tropical regions of the world. The principle of OTEC is simple, but the low thermal conversion efficiency when operating with such small temperature differences requires enormous flows of water for a reasonable power output and necessitates enormous components which tend to be expensive. The high capital cost of an OTEC plant suggests that the market will be greatest where its competition, electricity from fossil fuels, is most expensive; for example, island communities currently relying on imported oil. Although OTEC has been proven at the small scale and could be expected to operate at a larger one, there are few plants and OTEC seems unlikely to play anything more than a minor role as a generator of the world's electricity in the foreseeable future. It is primarily poor economics which militate against its exploitation as a renewable energy technology. (author). 4 refs, 3 figs.

1409 Solar Thermal Utilization

6536 (DOE/SF/16306–31) **Developing, testing, evaluating and optimizing solar heating and cooling systems: Status report, 1 September 1991–31 October 1991.** Colorado State Univ., Fort Collins, CO (United States). Solar Energy Applications Lab. Nov 1991. 25p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG03-86SF16306. Order Number DE92004644. Source: OSTI; NTIS; GPO Dep.

The objective is to develop and test various integrated solar heating, cooling and domestic hot water systems, and to evaluate their performance. Systems composed of new, as well a previously tested, components are carefully integrated so that effects of new components on system performance can be clearly delineated. The SEAL-DOE program includes six tasks which have received funding for the 1991–1992 fifteen-month period. These include: (1) a project employing isothermal operation of air and liquid solar space hearing systems, (2) a project to build and test several generic solar water heaters, (3) a project that will evaluate advanced solar domestic hot water components and concepts and integrate them into solar domestic hot water systems, (4) a liquid desiccant cooling system development project, (5) a project that will perform system modeling and analysis work on solid desiccant cooling systems research, and (6) a management task. The objectives and progress in each task are described in this report. 6 figs., 2 tabs.

6537 (ETSU-S–1197F) **Heat transfer through doorways in passive solar buildings.** Martin, C.; Watson, M. AEA Environment and Energy, Harwell (United Kingdom); Energy Monitoring Co. Ltd., Newport Paynell (United Kingdom). Mar 1990. 114p. Order Number DE92750023. Source: OSTI; NTIS (US Sales Only).

The work described in this document set out to improve the confidence with which thermal simulation modellers can treat the flow of energy through the doorways which connect the zones of a passive solar building. The study began by reviewing the requirements of the three models currently under consideration in the Passive Solar Programme, and by examining the theoretical treatment which can be used to obtain the input information required by those models. The models which require the user to specify the heat flow through doorways (SERI-RES and HTB2) do not model the pressure differences between zones, and thus only the buoyancy driven flow through doorways has been considered. Furthermore, as these models are generally used to produce predictions only down to an hourly timescale, the dynamic effects which occur on much shorter timescales when doors are opened and closed were also not considered. (author).

1410 Solar Collectors and Concentrators

Refer also to citation(s) 6524

6538 (IC–90/328) **A study of the flat plate solar collector in Guinea.** Boye Barry, M. International Centre for Theoretical Physics, Trieste (Italy). Dec 1990. 15p. Order Number DE92613775. Source: OSTI; NTIS (US Sales Only); INIS.

In this paper, we study a collector, made by cheap local materials (wood, aluminium, etc.), and prepared in the carpenteries, and in the mechanic work rooms with a simple technology. The efficiency of our collector is compared with several variants made in other countries. (author). 9 refs, 6 figs, 2 tabs.

6539 (NREL/TP–214-4486) **Photovoltaic Manufacturing Technology (PVMaT) improvements for ENTECH's concentrator module: Final technical report, 9 January 1991–14 April 1991.** O'Neill, M.J. (ENTECH, Inc., Dallas-Fort Worth Airport, TX (United States)); McDanal, A.J.; Perry, J.L.; Jackson, M.C.; Walters, R.R. National Renewable Energy Lab., Golden, CO (United States); ENTECH, Inc., Dallas-Fort Worth Airport, TX (United States). Nov 1991. 34p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE92001170. Source: OSTI; NTIS; GPO Dep.

This final technical report documents ENTECH's Phase 1 contract with Photovoltaic Manufacturing Technology (PVMaT) project. Under this project we prepared a detailed description of our current manufacturing process for making our unique linear Fresnel lens photovoltaic concentrator modules. In addition, we prepared a detailed description of an improved manufacturing process, which will simultaneously increase module production rates, enhance module quality, and substantially reduce module costs. We also identified potential problems in implementing the new manufacturing process, and we proposed solutions to these anticipated problems. Before discussing the key results of our program, however, we present a brief description of our unique photovoltaic technology. The key conclusion of our PVMAT Phase 1 study is that our module technology, without further breakthroughs, can realistically meet the near-term DOE goal of 12 cents/kWh levelized electricity cost, provided that we successfully implement the new manufacturing process at a production volume of at least 10 megawatts per year. The key recommendation from our Phase 1 study is to continue our PVMaT project into Phase 2A, which is directed toward the actual manufacturing technology development required for our new module production process. 15 refs.

6540 (SAND–91-7008) **Facet development for a faceted stretched-membrane dish by SAIC.** Sandia National Labs., Albuquerque, NM (United States); Science Applications International Corp., San Diego, CA (United States). Energy Projects Div. Oct 1991. 81p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789. Order Number DE92004475. Source: OSTI; NTIS; GPO Dep.

The concept for a multi-facet stretched-membrane dish concentrator could reduce the cost and weight of solar thermal dish systems. A stretched-membrane mirror facet for such a multi-facet solar dish concentrator has been developed by Science Applications International Corporation (SAIC). Twelve of the 3.7-m diameter facets will be used to form a 115-m^2 dish concentrator, providing 75 kW$_{th}$ to operate a 25-kW$_e$ Stirling engine for electric power production. The facet SAIC designed is focused using a vacuum system to elastically deform the thin (0.003-inch thick) stainless steel facet membranes. Elastic focusing was chosen over plastically deforming the membrane to a parabolic shape because it results in a simple manufacturing process. The SAIC facet can be focused from infinity to a minimum focal length-to-diameter ratio of about 2.7. Analytical design studies and experimental tests were performed to evaluate stresses in the ring and membranes during operation, the effects of strain cycling on the reflective surface, and to measure the optical quality of the mirror facets. SAIC produced two prototype mirror facets and they were optically tested at the Solar Energy Research Institute and at Sandia National Laboratories. The first facet showed slope errors ranging from 2.95 to 3.3 mrad over the f/d range of 2.7 to 3.0.

15 GEOTHERMAL ENERGY

6541 (DOE/ID/12489–116) **[Geosciences research and development]: Final report, July 1, 1985–February 28, 1991.** Utah Univ. Research Inst., Salt Lake City, UT (United States). Earth Science Lab. Mar 1991. 117p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC07-85ID12489. (ESL–91001-FR). Order Number DE92004818. Source: OSTI; NTIS; GPO Dep.

This report represents the final report of the University of Utah Research Institute under US Department of Energy Contract No. DE-AC07-85ID12489. It consists of the abstracts and references of all technical reports generated by UURI under this contract. This report lists the abstracts in DOE report number sequence. The author index of this report will be useful in locating specific references. These reports are all related to earth science and geothermal energy.

1502 Geology and Hydrology of Geothermal Systems

6542 (DOE/ER/14154–T1) **Fluid flow, element migration, and petrotectonic evolution of the early Mesozoic Central Klamath Island arc, northwesternmost California: Progress report, September 15, 1990–September 14, 1991.** Ernst, W.G. Stanford Univ., CA (United States). School of Earth Sciences. 13 Jun 1991. 2p. Sponsored by U.S. DOE Energy Research. DOE Contract FG03-90ER14154. Order Number DE92003770. Source: OSTI; NTIS; GPO Dep.

Short communication. CALIFORNIA/geothermal resources; VOLCANIC REGIONS/geology; VOLCANIC REGIONS/stratigraphy; PROGRESS REPORT; CALIFORNIA; GEOLOGY; STRATIGRAPHY; GRANTS; US DOE; RESEARCH PROGRAMS

6543 (LA-UR–91-1990) **Orientation of minimum principal stress in the hot dry rock geothermal reservoir at Fenton Hill, New Mexico.** Burns, K.L. Los Alamos National Lab., NM (United States). [1991]. 5p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-7405-ENG-36. (CONF-9110151–3: Geothermal Resources Council annual meeting and trade show, Reno, NV (United States), 6-9 Oct 1991). Order Number DE91014743. Source: OSTI; NTIS; GPO Dep.

The stress field at the source of microearthquakes in the interior of the hot dry rock geothermal reservoir at Fenton Hill appears to be different to the far field stress outside the reservoir. The stress field seems to be re-oriented prior to failure, during the course of processes that inflate the reservoir. The state of stress, both inside and outside, the hot dry rock (HDR) geothermal reservoir at Fenton Hill, is important in predicting the course of stress-dependent processes, and in transferring HDR technology developed at Fenton Hill, to sites, such as at Clearlake in California, where the stress field is expected to be substantially different. The state of stress at

Fenton Hill is not well known because of limitations in stress measuring technology. It is necessary to use a variety of indirect methods and seek an estimate of the stress. 5 refs.

1505 Economic, Industrial, and Business Aspects

Refer also to citation(s) 6545

1509 Geothermal Engineering

Refer also to citation(s) 7480

6544 (SAND–91-1848C) **An evaluation of flowmeters for the detection of kicks and lost circulation during drilling.** Schafer, D.M. (Sandia National Labs., Albuquerque, NM (United States)); Loeppke, G.E.; Glowka, D.A.; Scott, D.D.; Wright, K.E. Sandia National Labs., Albuquerque, NM (United States). [1991]. 8p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789. (CONF-920250–1: 1992 Society of Petroleum Engineers (SPE) drilling conference, New Orleans, LA (United States), 18-21 Feb 1992). Order Number DE92004209. Source: OSTI; NTIS; GPO Dep.

An independent evaluation of current industry standard and state-of-the-art drilling fluid inflow and outflow meters was conducted during the drilling of a geothermal exploratory well. Four different types of fluid inflow meters and three different types of fluid outflow meters were tested and evaluated during actual drilling operations. The tested drilling fluid inflow meters included conventional pump stroke counters, rotary pump speed counters, magnetic flow meters, and a Doppler ultrasonic flow meter. On the return flow line, a standard paddle meter, an acoustic level meter, and a prototype rolling float meter were evaluated to measure drilling fluid outflow rates. The prototype outflow meter utilizes a rolling float which rides on the surface of the flow thereby measuring the fluid height in the pipe. Both the prototype meter and the conventional paddle meter were also extensively tested under a variety of drilling conditions in a full-scale laboratory test facility. The meters were evaluated and compared on the basis of reliability and accuracy, and the results are presented in the paper.

1510 Direct Energy Utilization

6545 (EGG-EP–9839) **The feasibility of applying geopressured-geothermal resources to direct uses.** Lunis, B.C. (EG and G Idaho, Inc., Idaho Falls, ID (United States)); Negus-de Wys, J.; Plum, M.M.; Lienau, P.J.; Spencer, F.J.; Nitschke, G.F. EG and G Idaho, Inc., Idaho Falls, ID (United States). Sep 1991. 130p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC07-76ID01570. Order Number DE92003361. Source: OSTI; NTIS; GPO Dep.

This study concludes that direct use technologies, especially desalinated water production, can contribute significantly to the value added process and the overall economic viability in developing a geopressured resource. Although agriculture and aquaculture applications are marginal projects when they are the only use of a geopressured well, the small margin of profitability can contribute to improving the overall economics of the direct use development. The added complexity from a technical and management aspect may add to the overall risk and unpredictability of the project. Six combination of direct uses received economic evaluation that resulted in 15% discounted payback periods ranging from 4 to over 10 years. Many other combinations are possible depending on the resource and market variables. Selection of appropriate technologies and sizes of applications will be established by the developer that engages in geopressured resource utilization. Currently, many areas of the country where geopressured resources are located also have surplus electrical capacity and generation, thus power utilities have been selling power for less than 2 cents per kWH, well below a reasonable breakeven value for geopressured produced electricity. However, when the energy demand of the integrated geopressured facility is large enough to install power generation equipment, operating expenses can be reduced by not paying the 10 to 12 cents per kWH utility rate. The study includes an analysis of a geothermal turbine unit installed with a desalination and an agriculture/aquaculture facility, taking advantage of the cascading energy values. Results suggest that this scenario becomes profitable only where the market price for electricity exceeds five cents per kWH.

16 TIDAL AND WAVE POWER

1604 Economic, Industrial, and Business Aspects

Refer also to citation(s) 6546

1605 Environmental Aspects

6546 (IAEA-TECDOC–624, pp. 275-291) **Tidal energy.** Cavanagh, J. (UKAEA Harwell Lab. (United Kingdom). Energy Technology Support Unit). International Atomic Energy Agency, Vienna (Austria). Sep 1991. (CONF-910506–: Senior expert symposium on electricity and the environment, Helsinki (Finland), 13-17 May 1991). In *Electricity and the environment: Background papers for a senior expert symposium held in Helsinki, 13-17 May 1991.* 600p. Order Number DE92607903. Source: OSTI; NTIS (US Sales Only); INIS.

This paper describes tidal energy systems as a technology for electricity generation. After a consideration of the nature of tides and the potential world tidal energy resource the paper describes the present status of the technology, the elements which make-up a tidal scheme and the proposed methods of operation and construction. The environmental implications of tidal schemes are dealt with. The final section considers the economics of tidal power with particular reference to the proposed Severn tidal barrage in the UK. (author). 3 refs, 5 figs, 5 tabs.

17 WIND ENERGY

1706 Wind Energy Engineering

6547 (NREL/TP–257-4510) **Dynamic stall on wind turbine blades.** Butterfield, C.P. (National Renewable Energy Lab., Golden, CO (United States)); Simms, D.; Scott, G.; Hansen, A.C. National Renewable Energy Lab., Golden, CO (United States). Dec 1991. 9p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. (CONF-9109112–7: 21. American Wind Energy Association conference: windpower '91, Palm Springs, CA (United States), 24-27 Sep 1991). Order Number DE92001157. Source: OSTI; NTIS; GPO Dep.

Dynamic loads must be predicted accurately in order to estimate the fatigue life of wind turbines operating in turbulent environments. Dynamic stall contributes to increased dynamic loads during normal operation of all types of horizontal-axis wind turbine (HAWTs). This report illustrates how dynamic stall varies throughout the blade span of a 10 m HAWT during yawed and unyawed operating conditions. Lift, drag, and pitching moment coefficients during dynamics stall are discussed. Resulting dynamic loads are presented, and the effects of dynamic stall on yaw loads are demonstrated using a yaw loads dynamic analysis (YAWDYN). 12 refs., 22 figs., 1 tab.

6548 (NREL/TP–257-4518) **An overview: Challenges in wind technology development.** Thresher, R.W.; Hock, S.M. National Renewable Energy Lab., Golden, CO (United States). Dec 1991. 10p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. (CONF-9109112–8: 21. American Wind Energy Association conference: windpower '91, Palm Springs, CA (United States), 24-27 Sep 1991). Order Number DE92001190. Source: OSTI; NTIS; GPO Dep.

Developing innovative wind turbine components and advanced turbine configurations is a primary focus for wind technology researchers. In their rush to bring these new components and systems to the marketplace, designers and developers should consider the lessons learned in the wind farms over the past 10 years.

Experience has shown that a disciplined design approach is required that realistically accounts for the turbulence-induced loads, unsteady stall loading, and fatigue effects. This paper reviews past experiences and compares current modelling capabilities with experimental measurements in order to identify some of the knowledge gaps that challenge designers of advanced components and systems. 7 refs., 11 figs.

6549 (NREL/TP-257-4625) **The Federal Advanced Wind Turbine Program.** Hock, S.M. (National Renewable Energy Lab., Golden, CO (United States)); Thresher, R.W.; Goldman, P.R. National Renewable Energy Lab., Golden, CO (United States). Dec 1991. 7p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. (CONF-9109112-6: 21. American Wind Energy Association conference: windpower '91, Palm Springs, CA (United States), 24-27 Sep 1991). Order Number DE92001189. Source: OSTI; NTIS; GPO Dep.

The development of technologically advanced, higher efficiency wind turbines has been identified as a high priority activity by the US wind industry. The Department of Energy's Wind Energy Program has begun a multi-year development program aimed at assisting the wind industry with the design, development, and testing of advanced wind turbine systems that can compete with conventional electric generation for $0.05/kWh at 13 mph sites by the mid-1990s and with fossil-fuel-based generators for $0.04/kWh at 13 mph sites by the year 2000. The development plan consists of four phases: (1) Conceptual Design Studies; (2) Near-Term Product Development; (3) Next Generation Technology Integration and Design, and (4) Next- Generation Technology Development and Testing. The Conceptual Design Studies were begun in late 1990, and are scheduled for completion in the Spring of 1992. Preliminary results from these analyses are very promising and indicate that the goals stated above are technically feasible. This paper includes a brief summary of the Conceptual Design Studies and presents initial plans for the follow-on activities. 3 refs., 4 figs.

6550 (SAND-91-2386C) **The status of the US VAWT program.** Dodd, H.M.; Berg, D.E.; Ashwill, T.D.; Sutherland, H.J.; Schluter, L.L. Sandia National Labs., Albuquerque, NM (United States). [1991]. 20p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789. (CONF-9111131-1: Canadian Wind Energy Association (CWEA) meeting, Montreal (Canada), 4 Nov 1991). Order Number DE92002931. Source: OSTI; NTIS; GPO Dep.

Vertical axis wind turbine (VAWT) technology in the United States started in the early 1970s directly from the original work in Canada. The close, and very productive relationships among laboratories, universities and industry have continued since that time. This paper briefly discusses the significant technical progress and rather dramatic programmatic changes that have occurred in the past 18 to 24 months on the US side of the border. 20 refs., 14 figs.

20 FOSSIL-FUELED POWER PLANTS

2001 Power Plants and Power Generation

Refer also to citation(s) 6126, 6163, 6164, 6173, 6201, 6247, 6256, 6268, 6280, 6281, 6288

6551 (CONF-910571-, pp. 23-52) **Advanced power systems fired with low rank coals.** Wolk, R.H. (Electric Power Research Inst., Palo Alto, CA (United States)); McDaniel, J.E.; Stewart, N.C. North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. [1991]. From 16. biennal low-rank fuels symposium; Billings, MT (United States); 20-23 May 1991. In *Proceedings of the sixteenth biennial low-rank fuels symposium.* 535p. Order Number DE92002606. Source: OSTI; NTIS; INIS.

Even though there is a large and growing market for low rank coals, their high moisture content does increase shipping costs to power plants located near population centers. This provides a major opportunity for a lower moisture product which could reduce the delivered Btu cost to the consumer. Several projects have either recently begun operation or are under construction to provide such a product. Other new technologies have been developed to utilize low rank coals. Low rank coals fuel several fluidized bed combustion power plants. The Dakota Gasification, Inc. plant producing synthetic natural gas from lignite and Dow's IGCC plant generating electricity and steam from Wyoming subbituminous demonstrate the economic viability of this resource in more new technology applications. Low rank coals were also utilized in the early 1980s in large scale coal liquefaction demonstration facilities. More recently experimental programs have evaluated the hydrogenation of a mixture of low rank coals and residual oils. The approach appears to be economically promising. Other longer range approaches, including power plants based on combining coal gasification with molten carbonate fuel cells and MHD have been the subject of recent studies which indicate promising potential. This paper provides an overview of activities in these areas.

6552 (CONF-910571-, pp. 95-111) **Puentes Power Plant retrofitting: Use of Powder River Basin (P.R.B.) sub-bituminous coal.** Hidalgo, J.M. (Empresa Nacionale De Electricidad, S.A., Madrid (Spain)). North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. [1991]. From 16. biennal low-rank fuels symposium; Billings, MT (United States); 20-23 May 1991. In *Proceedings of the sixteenth biennial low-rank fuels symposium.* 535p. Order Number DE92002606. Source: OSTI; NTIS; INIS.

The guidelines, concerning the reduction of pollutant emissions into the atmosphere, given by the regulating agencies of the European Economic Community, obligate Spain to make a global reduction in phases in 1993, 1998, and 2003. The Puentes Thermal Power Station, with 1,400 MW(e), which fires local low range and high sulfur content coal, has to reduce its emissions of SO_2 in half. Steam generators are prepared according to German technology to burn lignite and have undergone a series of modifications to improve their efficiency and availability. This paper deals with the feasibility studies carried out with different ecological fuels (bituminous coals, natural gas, subbituminous coals, and mixes). Having in mind technical, economic, environmental and strategic reasons, conversion to subbituminous coal has been selected on the basis of the existence of the P.R.B. coal as a source of supply. The laboratory tests as well as the pilot tests at the facilities have confirmed the feasibility of burning P.R.B. coal using European technology for low range coals. This paper also details the most important parameters in the milling and combustion of the P.R.B. following the technology which is being applied in the US and compares them with the ones obtainable with the Puentes Power Station conversion.

6553 (CONF-910571-, pp. 112-124) **Blending of eastern and western coal: Results of a test burn at Joppa Station.** Selle, S.J. (Northwest Research, Inc., Grand Forks, ND (United States)); Dorris, H.L.; Sobule, J.A. North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. [1991]. From 16. biennal low-rank fuels symposium; Billings, MT (United States); 20-23 May 1991. In *Proceedings of the sixteenth biennial low-rank fuels symposium.* 535p. Order Number DE92002606. Source: OSTI; NTIS; INIS.

Electric Energy Inc., prompted by concerns over pending stack emission standards and future fuel costs, performed a test burn on Unit 5 at its Joppa Station during December 1989 and January 1990. A low-sulfur, low-ash Powder River Basin (PRB) subbituminous coal from the Caballo Rojo mine located in northeastern Wyoming was selected for the test burn. Unit 5 characteristics include closely-spaced convective tubes, a finned-tube economizer, compressed air soot blowers, lower pulverizer inlet air temperatures by subbituminous standards and a small electrostatic precipitator (ESP). The test burn had two main objectives: (1) to establish the viability of a blend containing 25 percent Caballo Rojo with their current fuels, and (2) to establish plant limitations at higher proportions of PRB coals up to 100 percent. Results at the 25/75, Caballo Rojo/Sahara, blend ratio showed that this blend could be utilized at Joppa while maintaining full load with a spare pulverizer and with no reduction in ESP effectiveness. No load reduction was necessary at a 50/50 blend ratio and a spare mill was still available, however, ESP performance declined. A 75/25 ratio required the use of all pulverizers, resulted in a 6 percent load reduction due to ID fan capacity and caused a further deterioration in ESP performance. ESP effectiveness returned to its original level at 100 percent Caballo Rojo, but a 14 percent load reduction was required.

6554 (CONF-910571–, pp. 256-270) **Alternative technologies for the generation of electricity from Victorian brown coal.** Anderson, B. (State Electricity Commission of Victoria, Richmond (Australia)); Johnson, T. North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. [1991]. From 16. biennal low-rank fuels symposium; Billings, MT (United States); 20-23 May 1991. In *Proceedings of the sixteenth biennial low-rank fuels symposium.* 535p. Order Number DE92002606. Source: OSTI; NTIS; INIS.

The State Electricity Commission of Victoria is conducting a program of research and development into alternatives to the use of conventional boilers for the generation of electricity from brown coal. The objective of the program is to reduce the cost of electricity and also to improve the thermal efficiency so as to reduce the emission of greenhouse gases. The program presently includes the following four technologies: Hydro-thermal Drying, Direct Coal Fired Gas Turbine, Integrated Gasification Combined Cycle, and Steam Fluidized Bed Drying. This paper concentrates on the first two projects. The Coal Fired Gas Turbine (CFGT) is being pursued because it offers the possibility of cheap electricity at relatively high efficiency when combined with a steam bottoming cycle. The Hydro-thermal drying (HTD) process is being developed to provide a coal-water-slurry fuel for the CFGT. Victorian brown coal is a good candidate for this application because of its low ash and sulphur content. The HTD process produces a combustible slurry containing a minimum of sodium and it also facilitates the addition of water-soluble additives to control ash fouling and corrosion. Following the successful testing of a sample of Victorian brown coal in the Hot Water Drying Process Development Unit and Turbine Simulator at the Energy and Environmental Research Center, Grand Forks, it was decided to construct an HTD Pilot Plant and a Turbine Simulator at the Herman Research Laboratory. Details of the plant and some results from the preliminary tests are given in the paper.

6555 (CONF-910571–, pp. 285-300) **BHEL's moving bed gasification technology for IGCC application.** Sridhar, S. (Bharat Heavy Electricals Ltd., Hyderabad (India)); Krishnamoorthy, S.; Bheemaiah, P.; Duraikannu, M.; Ramani, N.V.S. North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. [1991]. From 16. biennal low-rank fuels symposium; Billings, MT (United States); 20-23 May 1991. In *Proceedings of the sixteenth biennial low-rank fuels symposium.* 535p. Order Number DE92002606. Source: OSTI; NTIS, INIS.

Bharat Heavy Electricals Ltd. (BHEL) has developed a technology for efficient utilization of low grade, high ash coals to introduce efficient energy conversion systems into the Indian power scene to conserve fuel. The details of the moving bed coal gasification technology developed for the Combined Cycle Demonstration Plant (CCDP) and its performance are outlined in this paper. This paper describes the combined cycle concept, ignition by steam activation, control systems and instrumentation, the heat recovery system, plant performance, and a mathematical model.

6556 (CONF-910571–, pp. 378-391) **Coal-fired magnetohydrodynamic power generation status and demonstration designs.** Walter, F. (Montana Power Co., Butte (United States)); Sherick, J.; Labrie, R.J. North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. [1991]. From 16. biennal low-rank fuels symposium; Billings, MT (United States); 20-23 May 1991. In *Proceedings of the sixteenth biennial low-rank fuels symposium.* 535p. Order Number DE92002606. Source: OSTI; NTIS; INIS.

Magnetohydrodynamics (MHD) is a direct coal-burning, high-efficiency, advanced fossil fuel technology that is environmentally acceptable for generating electric power. The development of MHD technology has advanced to where it can be demonstrated at the 250-megawatt thermal (MWt) level around the year 2000. The operational data from the MHD test facilities have verified MHD's potential and are summarized in the text. Of particular significance are: the sulfur oxides (SO_x), nitrogen oxides (NO_x), and particulate reductions achieved; confirmation of predicted efficiency; and operability and durability of test articles. The Department of Energy (DOE) Proof-of-Concept (POC) Multiyear Program will provide the reliability, durability data on commercial prototypic hardware by 1993. The POC program and its development is described. The feasibility of a 250-MWt MHD retrofit or demonstration plant has been verified in site-specific conceptual designs. Assessment of feasibility, performance, cost and schedule is reviewed for the study on Montana Power Company's J.E. Corette Plant. The strategic plan for bringing this MHD demonstration project into reality is outlined. These successful programs have proven MHD has the potential to be an important electric power generation technology for the 21st Century.

6557 (CONF-910571–, pp. 392-405) **Economic analysis of coal-fired magnetohydrodynamics.** Lohrasbi, J. (MSE, Inc., Butte, MT (United States)); Ashby, G.; Walter, F.E. North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. [1991]. From 16. biennal low-rank fuels symposium; Billings, MT (United States); 20-23 May 1991. In *Proceedings of the sixteenth biennial low-rank fuels symposium.* 535p. Order Number DE92002606. Source: OSTI; NTIS; INIS.

This study is an economic comparison of the coal-fired magnetohydrodynamics (MHD) technology with conventional coal-fired steam power plants; the comparisons made are based on a levelized 'Cost of Electricity' for similarly sized plants. A revenue requirement analysis was used for the economic evaluation of engineering alternatives in the electric utility industry. The basis for the MHD technology used in the comparison is a recently completed conceptual design done by the MHD Development Corporation for retrofitting the coal-fired J.E. Corette plant with a 250-MW(t) MHD unit. A 500-MW(e) MHD consideration is based on the 'Advanced Power Train' predictions of the Department of Energy (DOE), and conventional plant considerations are based on the Technical Assessment Guide of the Electric Power Research Institute (EPRI). The economic comparisons indicate that MHD is considerably more attractive than a conventional unit.

6558 (CONF-910571–, pp. 490-500) **Full scale milling and burning tests of brown coal and sub-bituminous coal mixtures.** Ramos, J. (Endesa C.T., La Coruna (Spain)); Lucas, T.; Quintana, C.; Casares, J.J. North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. [1991]. From 16. biennal low-rank fuels symposium; Billings, MT (United States); 20-23 May 1991. In *Proceedings of the sixteenth biennial low-rank fuels symposium.* 535p. Order Number DE92002606. Source: OSTI; NTIS; INIS.

The Puentes 1400 MW power plant in Galicia, Spain, has burned the local brown coal with high sulfur content since start-up in April, 1976. A number of combustion-derived problems occurred right from the start. Early modifications alleviated some of these, but a number of major problems remained unsolved for almost a decade. When these combustion problems were finally solved, a decision was made to reduce SO_2 emissions significantly. The paper described the most significant results of combustion tests conducted on mixtures of the local brown coal and Powder River Basin sub-bituminous coal.

6559 (DOE/PC/90160–T3) **Advanced atomization concept for CWF burning in small combustors: Phase 2, Quarterly technical progress report No. 3, 1 April 1991–30 June 1991.** Heaton, H.; McHale, E. Atlantic Research Corp., Alexandria, VA (United States). 1991. 22p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-90PC90160. Order Number DE92004875. Source: OSTI; NTIS; GPO Dep.

The present project involves the second phase of research on a new concept in coal-water fuel (CWF) atomization that is applicable to burning in small combustors. It is intended to address the most important problem associated with CWF combustion; i.e., production of small spray droplets in an efficient manner by an atomization device. Phase 1 of this work was successfully completed with the development of an opposed-jet atomizer that met the goals of the first contract. Performance as a function of operating conditions was measured, and the technical feasibility of the device established in the Atlantic Research Atomization Test Facility employing a Malvern Particle Size Analyzer. Testing then proceeded to a combustion stage in a test furnace at a firing rate of 0.5 to 1.5 MMBtu/H.

6560 (ETDE-mf–2750173) **Development of a flexible power station program S.O.KR.A.T.E.S. with simultaneous technique of solutions in relation with the survey of modern power station concepts.** Werner, K. Essen Univ. (Gesamthochschule) (Germany). Fachbereich 13 - Energie-, Verfahrens- und Elektrotechnik. 17 Dec 1990 374p. (In German). Order Number DE92750173. Source: OSTI; NTIS (US Sales Only).

The work presented deals with the further development and use of a simulation program for power station processes. As a decisive objective, presentation is made on how to create a tool that, in regard to calculating thermal energy conversion, is universally implementable. In this case, however, the use even by non-programmers should be granted simultaneously, preferably unrestricted. A comparison of the principle technique of solution indicates first of all that simultaneous methods are more likely to contradict to the diverse, concivable problem definitions than sequential calculations. The use of the closed approach, however, goes along with the restriction that extensions in the program are handicaps themselves. Even though only one so-called open system appears purposeful in terms of the rapidly advanced research and development in the area of power station technology, the coupling of newly created algorithms is investigated in a special degree. For this purpose, a procedure is selected which depicts the way to include external calculations by selecting suitable interfaces. The characteristic of the closed technique of solution takes advantage of this type of step by providing a wide-range offer for user-specific defaults. Analogous to these gained experiences, further program development was made especially concerning material value and combustion calculation, and, in regard to the adaption to other computer systems, also was directed toward the standardization of programming languages. The appropriately modified program system subsequently led to the option in the last section of the work to investigate three projects of future power station processes. The selection could be coordinated in such a way that all major problem definitions occur that are relevant to the thematic currently being discussed. (orig./UA).

6561 **Destruction of acid gas emissions.** Mathur, M.P.; Fu, Yuan C.; Ekmann, J.M.; Boyle, J.M. To Dept. of Energy. 1990. Filed date 22 Jun 1990. USA Patent patent application 7-541,992. 16p. Sponsored by U.S. DOE Fossil Energy. Order Number DE92003812. Source: OSTI; NTIS; GPO Dep.

A method of destroying NO_x and SO_x in a combustion gas is disclosed. The method includes generating active species by treating stable molecules in a high temperature plasma. Ammonia, methane, steam, hydrogen, nitrogen or a combustion of these gases can be selected as the stable molecules. The gases are subjected to plasma conditions sufficient to create free radicals, ions or excited atoms such as N, NH, NH_2, OH, CH and/or CH_2. These active species are injected into a combustion gas at a location of sufficiently high temperature to maintain the species in active state and permit them to react with NO_x and SO_x. Typically the injection is made into the immediate post-combustion gases at temperatures of 475–950°C. 1 fig.

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Refer also to citation(s) 6123, 6230, 6231, 6232, 6233, 6234, 6236, 6242, 6243, 6244, 6245, 6246, 6270, 6271, 6272, 6273, 6274, 6277, 6280, 6283, 6552, 6553, 6558, 6561, 6870, 7549

6562 (CONF-910571–, pp. 126-154) **Stationary combustion NO_x control: A summary of the 1991 symposium.** Kokkinos, A. (Electric Power Research Inst., Palo Alto, CA (United States)); Cichanowicz, J.E.; Hall, R.E.; Sedman, C.B. North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. [1991]. From 16. biennal low-rank fuels symposium; Billings, MT (United States); 20-23 May 1991. In *Proceedings of the sixteenth biennial low-rank fuels symposium.* 535p. Order Number DE92002606. Source: OSTI; NTIS; INIS.

The 1991 Symposium on Stationary Combustion NO_x Control was held March 25-28, 1991, in Washington, DC. The sixth meeting in a biennial series, the Symposium was cosponsored by the Electric Power Research Institute (EPRI) and the US Environmental Protection Agency (EPA). Approximately 500 individuals attended representing 53 domestic and 13 foreign utility companies, federal and state government agencies, research and development organizations, and equipment vendors from the US and abroad. Sixty-six presentations were made. This paper focuses on new results and understandings since the last Symposium in 1989 (JAPCA, August 1989) as they pertain to electric utility power plants and other boilers burning coal, oil, and gas. Key points include the significant increase in full-scale retrofit demonstrations of low-nitrogen oxide (NO_x) combustion systems in the US and abroad over the past two years; full-scale operating experience in Europe with selective catalytic reduction (SCR); pilot- and bench-scale SCR investigations in the US; increased attention on selective noncatalytic reduction (SNCR) in the US; and NO_x controls for oil- and gas-fired boilers.

6563 (CONF-910571–, pp. 344-360) **Houston Lighting and Power Company's coal combustion by-products utilization program: A decade of success.** Prusinski, J.R. (Houston Lighting and Power Co., Houston, TX (United States)); Weber, J.L.; Martinez, C.G.; Nichols, M.E. North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. [1991]. From 16. biennal low-rank fuels symposium; Billings, MT (United States); 20-23 May 1991. In *Proceedings of the sixteenth biennial low-rank fuels symposium.* 535p. Order Number DE92002606. Source: OSTI; NTIS; INIS.

Houston Lighting and Power Company (HL and P) maintains two separate facilities with low-rank fuel fired units: the W.A. Parish Generating Station and the Limestone Electric Generating Station. The Parish plant has been operational since 1978 and has developed a successful coal combustion by-product utilization program. The Limestone plant, on line since 1985, produces a low quality ash and is located in a remote rural area thus severely limiting marketability of its ash. In 1990, W.A. Parish produced 480,000 tons of fly ash, bottom ash and fluidized gas desulfurization sludge (also referred to as 'scrubber base'). 61% of all by-products produced and 71% of fly ash in particular were marketed. Several factors have contributed to these high utilization rates: (1) product quality, (2) relationship with ash contractor/marketer, (3) ash management facilities, (4) quality assurance and control program, (5) sales and marketing efforts, (6) product line, (7) attention to industry, legislative and environmental concerns and (8) research and development programs. The Parish plant produces a high calcium Class C fly ash which is used principally as a low cost partial substitute for cement in concrete. Other applications for fly ash, bottom ash and scrubber base include secondary road construction, structural fills, waste processing and chemical fixation, brick manufacturing and soil stabilization. Several specific utilization applications both external and internal to HL and P are described. HL and P's research and development program includes deployment of artificial reefs, use of fly ash in precast/prestressed concrete products, use of fly ash to stabilize hazardous wastes and development of sulfate-resistant Class C fly ash concrete.

6564 (CONF-910571–, pp. 361-376) **Utilization of low-rank coal fly ash in high applications at a North Dakota power station.** Stewart, A.W. (Cooperative Power Association, Eden Prairie, MN (United States)). North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. [1991]. From 16. biennal low-rank fuels symposium; Billings, MT (United States); 20-23 May 1991. In *Proceedings of the sixteenth biennial low-rank fuels symposium.* 535p. Order Number DE92002606. Source: OSTI; NTIS; INIS.

In 1988 the North Dakota Mining and Mineral Resources Research Institute received an EPRI grant to study the construction and environmental aspects of a high volume cement replacement project was to demonstrate the use of a Class C fly ash to replace approximately 70% of the Portland cement in concrete and also to demonstrate its use in a flowable-slurry backfill material. Fresh fly ash from the Coal Creek Station, located near Falkirk, North Dakota, was used to make concrete for paving several roads and parking lots at the station and to make slurry for back filling several culverts. Twenty-five thousand square yards of pozzocrete and 35 cubic yards of slurry were placed for this project. The project was organized with four major tasks: (1) background monitoring, (2) construction monitoring, (3) environmental monitoring, and (4) post-construction performance monitoring of the concrete and slurry. Each of these are described. The replacement of a high volume of cement with Class C fly ash is an economical and viable practice. Based upon the results of over 5 years of traffic and freeze-thaw cycles on the pozzocrete placed at Coal Creek Station, the long term functionality has been proven. Construction techniques for concrete pavement, when properly applied, allow for the placement of pozzocrete in a proven fashion. This demonstration project should provide the data necessary to strengthen and increase the use of fly ash as a valuable engineering resource.

6565 (CONF-910571–, pp. 431-444) **Northern States Power Company Sherburne County Units 1 and 2 fly ash pond slope protection.** Pieper, L. (Northern States Power Company, Minneapolis, MN (United States)); Bluhm, S.; Moretti, C.; Dockter, B. North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. [1991]. From 16. biennal low-rank fuels symposium; Billings, MT (United States); 20-23 May 1991. In *Proceedings of the sixteenth biennial low-rank fuels symposium.* 535p. Order Number DE92002606. Source: OSTI; NTIS; INIS.

Sherburne County Generation Plant (Sherco) Units 1 and 2 have limestone wet scrubbers to collect sulfur dioxide and fly ash. All the solids collected in the scrubbers are slurried to a storage pond. Construction of the pond placed the riprap only part-way up the slope. The water level in the pond is now high enough to require addition riprap. This project looks at fly ash from Riverside Unit 8 and Sherco Unit 3 as potential substitute materials for riprap, to protect pond slopes from erosion and to reduce costs. The laboratory testing had two phases. Phase 1 studied the fly ashes using four possible placement methods and three moisture levels for each placement method, for a total of 24 mixes of fly ash as possible slope protection material. Unconfined compressive strength tests were run on these 24 mixes. Using the results of the strength tests, nine mixes were chosen for Phase 2 of the laboratory testing. Phase 2 consisted of freeze-thaw resistance and erosion resistance tests. In addition to the testing mentioned above, an economic analysis of the placement methods was done on the mixes. The field testing also has two phases. Phase 1 of the field testing had six mixes selected using the results of the laboratory testing and the economic analysis. The placing of the mixes in the field helped to determine what equipment should be used to place the new slope protection material. Additional work was done on the economic analysis. Phase 2 field testing mix could have been any of the mixed used in Phase 1. The mix is Sherco 3 ash to be placed by compaction.

6566 (DOE/PC/88852-T3-Rev.1) **Duct injection technology prototype development: Materials corrosion report, Revision 1.** Harper, S.L. (Babcock and Wilcox Co., Alliance, OH (United States). Research and Development Div.). United Engineers and Constructors, Inc., Denver, CO (United States). Stearns-Roger Div.; Babcock and Wilcox Co., Alliance, OH (United States). Contract Research Div. Aug 1991. 42p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-88PC88852. Order Number DE92001791. Source: OSTI; NTIS; GPO Dep.

This report describes a test program conducted to determine the corrosion rate of materials in the dry scrubber or duct injection systems. Four materials were evaluated: 1010 carbon steel, Corten, 317SS and Hastelloy C-276. The results show that acidic conditions result in higher corrosion rates than alkaline conditions for all the materials. The carbon steel, Corten and stainless steel show moderate to heavy pitting attack in the acidic environment. For the alkaline conditions, the corrosion rates of carbon steel and Corten were higher than the stainless steel or Hastelloy C-276. Also, the corrosion rate of abraded specimens were four time those of unabraded specimens in the flue gas. It is probable that areas of wall-wetting and plugging in the duct injection process will exhibit high rates of corrosion for the carbon steel, Corten, and stainless steel materials. General corrosion and pitting corrosion will predominate. Additionally, abraded duct areas will corrode at a significantly higher rate than unabraded duct materials. 6 refs., 11 figs., 7 tabs.

6567 (DOE/PC/88868–T6) **Characterization and modification of particulate properties to enhance filtration performance: Quarterly technical progress report, March 1989–May 1989.** Snyder, T.R.; Robinson, M.S.; Vann Bush, P. Southern Research Inst., Birmingham, AL (United States). 22 Jun 1989. 47p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-88PC88868. Order Number DE92003088. Source: OSTI; NTIS; GPO Dep.

This report describes the results of project activities that occurred during the period from March 1 through May 31, 1989. The organization of this report generally follows the outline of work presented in the Project Work Plan. Work performed during this period included tests under Task 2 – Parametric Tests of Ashes and Fabrics, and Task 3 – Survey of Methods to Modify Particle Filtration Properties. Discussion of the Task 2 work has been organized topically, rather than adhering to the activities specified in the Work Plan. Cohesive ash from the Tennessee Valley Authority's 160 MW Atmospheric Fluidized-Bed Combustor at the Shawnee Plant in Paducah, Kentucky was obtained during this quarter and has been analyzed in the laboratory. The second phase of the abstract search and review of pertinent articles included in activity 3.1 is nearly complete. A summary of this phase of the literature search is included in this report. A variety of potential conditioning agents have been evaluated during this reporting period. These agents include sodium bicarbonate, hydrated lime, various grades of fine silica powder, gasifier char, glass beads and glass fibers. The three source ashes have been mixed with these agents in different concentrations and using various mixing techniques. These tests are continuing, and this report contains a summary of the combinations evaluated during this past quarter. 17 figs., 7 tabs.

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Refer also to citation(s) 6248

6568 (ANL/CP-74787) **Greenhouse gas emissions control by economic incentives: Survey and analysis.** South, D.W.; Kosobud, R.F.; Quinn, K.G. Argonne National Lab., IL (United States). [1991]. 13p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-31109-ENG-38. (CONF-911184–7: 13. annual North American conference of the International Association for Energy Economics, Chicago, IL (United States), 18-20 Nov 1991). Order Number DE92004125. Source: OSTI; NTIS; GPO Dep.

This paper presents a survey of issues and concerns raised in recent literature on the application of market-based approaches to greenhouse effect policy with an emphasis on tradeable emission permits. The potential advantages of decentralized decision-making – cost-effectiveness or allocation efficiency, stimulation of innovations, and political feasibility are discussed. The potential difficulties of data recording, monitoring, enforcement, and of creating viable emission permit contracts and markets are examined. Special attention is given to the problem of designing a greenhouse effect policy that is cost-effective over time, a problem that has been given little attention to date. Proposals to reduce or stabilize greenhouse gas emission (especially CO_2) in the short run require high carbon tax rates or permit prices and impose heavy adjustment costs on the fossil fuel industry. A more cost-effective time path of permit prices is proposed that achieves the same long-run climate change stabilization goals. 21 refs., 3 figs.

2006 Economic, Industrial, and Business Aspects

Refer also to citation(s) 6107, 6823

21 NUCLEAR POWER REACTORS AND ASSOCIATED PLANTS

Refer also to citation(s) 6627

6569 (IAEA-TECDOC–621) **Good practices for outage management in nuclear power plants.** International Atomic Energy Agency, Vienna (Austria). Sep 1991. 204p. Order Number DE92615098. Source: OSTI; NTIS (US Sales Only); INIS.

As a follow-up to an earlier Technical Document on Good Practices for Improved Nuclear Power Plant Performance (IAEA-TECDOC-498), the Agency has produced a more focused technical report on good practices associated with nuclear power plant outage planning and execution. As with the earlier document, the overall aim is that by identifying good practices in the key aspects of outage management, overall world nuclear performance will improve and the gap between excellent performers and operators with developing programmes will be narrowed. This document has been produced through the contribution of numerous operators and government agencies. It aims at minimizing text and focusing on actual good practices in use which can be found in the annexes. While the specific methods used to achieve excellence in maintenance/refuelling outages may differ, the fundamental requirements of outage management are discussed.

6570 (IAEA-TECDOC--627) **Catalogue of methods, tools and techniques for recovery from fuel damage events.** International Atomic Energy Agency, Vienna (Austria). Oct 1991. 339p. Order Number DE92615099. Source: OSTI; NTIS (US Sales Only); INIS.

On the basis of the recommendations of the Advisory Group Meeting on Main Principles of Safe Management of Severely Damaged Nuclear Fuel and other Accident Generated Waste, held from 13 to 16 November 1989, the IAEA initiated a programme in 1990 to collect technical information on special tools and methods to deal with circumstances beyond the normal design basis of fuel damage. A Questionnaire was sent out to solicit information from the Member States and organizations which might have experience in this field. The responses to the Questionnaire were discussed at a Consultants Meeting and at an Advisory Group Meeting during 1990. The aim of this document is to disseminate the experience gained in Member States serving Article 5 of the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency and also filling a potential void in response to fuel damage events of less severe magnitude.

6571 (IAEA-TECDOC--632) **ASSET guidelines. Revised 1991 Edition: Reference material prepared by the International Atomic Energy Agency for Assessment of Safety Significant Events Teams.** International Atomic Energy Agency, Vienna (Austria). Dec 1991. 150p. Order Number DE92615100. Source: OSTI; NTIS (US Sales Only); INIS.

The present publication is an updated version of the IAEA Assessment of Safety Significant Events Team (ASSET) Guidelines, IAEA-TECDOC-573, published in 1990. Sections 5 and 6 include revised definitions and investigation guidelines for identification of both direct and root causes. These revisions were recommended by a Consultants Meeting held in Vienna on 3-7 December 1990. This guidance is not intended to infringe an expert's prerogative to investigate additional items. Its main purpose is to provide a basic structure and ensure consistency in the assessments. Use of the ASSET guidelines should also facilitate comparison between the observations made in different nuclear power plants and harmonize the reporting of generic ASSET results. The guidelines should always be used with a critical attitude and a view to possible improvements.

6572 (INIS-mf--13066) **Power engineering constructions: Project design procedure.** Chalus, Z.; Misterka, V.; Horak, P. Ceske Energeticke Zavody, Prague (Czechoslovakia). 1991 92p. (In Czech). Order Number DE92613801. Source: OSTI; NTIS (US Sales Only); INIS.

Methods and applications of the design procedure, looked upon as a manifestation of management skills, are described on examples of the Finnish and French state power companies IVO and EdF, respectively. For understanding the activities at IVO, facts concerning the development of the organization structure of this joint-stock company and its rules as well as basic data of the Finnish power industry are given. The IVOSTUDY program package used for decision-making in the field of capital investments is described, as are the information systems employed by the managements of IVO and EdF. The management program systems ARTEMIS, BASIS, AFORA PMS and APROS are also discussed and experience from their use by the two companies is summarized. (J.P.).

6573 (KFK--4837) **KfK, Institute for Reactor Development. Results of research and development activities in 1990.** Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Reaktorentwicklung (IRE). Mar 1991. 29p. (In German). Order Number DE92759305. Source: OSTI; NTIS (US Sales Only); INIS.

R and D activities at IRE (Institut fuer Reaktorentwicklung-Institute for Reactor Development) are dedicated to power engineering and handling processes in the framework of the point-of-main-effort projects 'nuclear fusion', 'solid-state and materials research', 'handling', 'nuclear safety' and 'miscellaneous research'. Nuclear fusion contributions deal with special vacuum system design problems, heavy-duty design and materials selection and safety aspects. Specimens from 30 different carbon-based materials were subjected to comparative tests in a plasma spraying plant. In the framework of solid-state and materials research activities a viscoplastic model for mechanical component analysis was investigated for its compatibility with elementary physical laws under complex loads. The handling project was dedicated to the specific requirements of nuclear fusion with regard to JET and NET uses, the development of system solutions for flexible industrial techniques, and to standardization. A study on the control system of a work station for NET remote handling tasks was completed. In the framework of the nuclear safety project one currently investigates the dynamics of fast reactors under failure conditions, the possible propagation of local cooling failures in the reactor core, and core monitoring problems. (orig./GL).

2101 Power Reactors, Nonbreeding, Light-Water Moderated, Boiling Water Cooled

Refer also to citation(s) 6581, 6622, 6623, 6629, 6690, 6704, 6706, 6724, 6728, 6729, 6730, 6731, 6732, 6733, 6735, 6736, 6746, 6749, 6751, 6755, 6756, 6758

6574 (NUREG/CR--5645) **Acoustic emission/flaw relationships for inservice monitoring of LWRs.** Hutton, P.H. (Pacific Northwest Lab., Richland, WA (United States)); Kurtz, R.J.; Friesel, M.A.; Skorpik, J.R.; Dawson, J.F. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Engineering; Pacific Northwest Lab., Richland, WA (United States). Oct 1991. 116p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC06-76RL01830. (PNL--7479). Source: OSTI; NTIS; INIS; GPO.

The program concerning Acoustic Emission/Flaw Relationships for Inservice Monitoring of LWRs was initiated in FY76 with the objective of validating the application of acoustic emission (AE) to monitor nuclear reactor pressure-containing components during operation to detect cracking. The program has been supported by the US Nuclear Regulatory Commission, Office of Nuclear Regulatory Research. Research and development has been performed by Pacific Northwest Laboratory, operated for the Department of Energy by Battelle Memorial Institute. The program has shown the feasibility of continuous, on-line AE monitoring to detect crack growth and produced validated methods for applying the technology. Included are relationships for estimating flaw severity from AE data and field applications at Watts Bar Unit 1 Reactor, Limerick Unit 1 Reactor, and the High Flux Isotope Reactor. This report discusses the program scope and organization, the three program phases and the results obtained, standard and code activities, and instrumentation and software developed under this program.

6575 (ORNL/CSD/TM--268) **Feasibility assessment of burnup credit in the criticality analysis of shipping casks with boiling water reactor spent fuel.** Broadhead, B.L. Oak Ridge National Lab., TN (United States). Aug 1991. 44p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC05-84OR21400. (TTC--1033). Order Number DE92002402. Source: OSTI; NTIS; INIS; GPO Dep.

Considerable interest in the allowance of reactivity credit for the exposure history of power reactor fuel currently exists. This "burnup credit" issue has the potential to greatly reduce risk and cost when applied to the design and certification of spent fuel casks used for transportation and storage. Recently, analyses have demonstrated the technical feasibility and estimated the risk and economic incentives for allowing burnup credit in pressurized water reactor (PWR) spent fuel shipping cask applications. This report summarizes the extension of the previous PWR technical feasibility assessment to boiling water reactor (BWR) fuel. This feasibility analysis aims to apply simple methods that adequately characterize the time-dependent isotopic compositions of typical BWR fuel. An initial analysis objective was to identify a simple and reliable method for characterizing BWR spent fuel. Two different aspects of fuel characterization were considered:I first, the generation of burnup dependent material interaction probabilities; second, the prediction of material inventories over time (depletion). After characterizing the spent fuel at various stages of exposure and decay, three dimensional (3-D) models for an infinite array of assemblies and, in several cases, infinite arrays of assemblies in a typical shipping cask basket were analyzed. Results for assemblies without a basket provide reactivity control requirements as a function of burnup and decay, while results including the basket allow assessment of typical basket configurations to provide sufficient reactivity control for spent BWR fuel. Resulting basket worths and reactivity trends over time are then evaluated to determine whether burnup credit is needed and feasible in BWR applications.

6576 (PSI–108) **Effective void fraction for a BWR assembly with boiling in the bypass region.** Galperin, A. (Ben-Gurion Univ. of the Negev, Beersheba (Israel)); Segev, M.; Knoglinger, E. Paul Scherrer Inst. (PSI), Villigen (Switzerland). Sep 1991. 90p. (STARS–5.). Order Number DE92613804. Source: OSTI; NTIS (US Sales Only); INIS.

Average BWR assembly cross-sections for nominal conditions, namely for zero bypass void, can be utilised in the analysis of transient conditions with boiling in the bypass. A model is developed to yield an effective channel void for such conditions. The use of this void in conjunction with the 'nominal conditions' cross section library approximately preserves the assembly K-infinity corresponding to the true channel and bypass voids. The effective void is an augmentation of the actual channel void. The augment is proportional to the bypass-to-channel volume ratio, to the bypass void, and to a weight W which is introduced to quantify the fact that a water molecule in the bypass has a different assembly criticality worth than one in the channel. The formula developed is superior to the practice of choosing W=1, namely a simple, non-weighted, transfer of water from channel to bypass. The use of this approximate effective channel void reproduces actual K-infinity values of assemblies to better than 5 mk, whereas the use of a simple model sometimes misspredicts the assembly K-infinity by 40 mK. The effective void model cannot handle cases in which both channel and bypass void value are high, simply because then the effective void α_{ch}^{eff} becomes meaningless. A method to treat the $\alpha^{eff}>1$ domain is developed by which corrections to cross sections are provided. Such corrections are synthesised as functions of the assembly parameters. (author) figs., tabs., refs.

6577 (SV-U–91-41) **Long-time measurements of prestressed tendon forces in reactor containment, Forsmark nuclear power station, unit 1.** Hallbjoern, L. Swedish State Power Board, Vaellingby (Sweden). 25 Jan 1991. 53p. (In Swedish). Order Number DE92615103. Source: OSTI; NTIS (US Sales Only); INIS.

The purpose of the measurements has been to determine the time-dependent force variation in the tendons. The measurements have now been performed during 14 years and the results are reported here. Measurements can continuously be carried out also in the future. The tendon forces are decreasing with time. The force reduction is the sum of the following three parts: stress loss due to concrete shrinkage, concrete creep and prestressing steel relaxation. The measurement results can be compared with the originally assumed long-time prestress losses. The force decrease in the tendons follow a straight line when illustrated in a diagram with logarithmic time-axis. At the distinct temperature-rise in the building when power generation started 4-5 years after prestressing this line will get a sharp bend so that the latter part of the line will have a greater slope than the former part. The prestressing force losses extrapolated to 30 years are just less than half the losses assumed in the design calculations. These favourable results from measurements during 14 years are valuable with respect to the actual structure and also to other structures of same or similar kind. The measurements have been made possible from the fact that the tendons have not been cement-grouted. They were left in their ducts with a corrosion protection of circulating dried air. (au).

2102 Power Reactors, Nonbreeding, Light-Water Moderated, Nonboiling Water Cooled

Refer also to citation(s) 6574, 6604, 6622, 6623, 6629, 6632, 6633, 6641, 6649, 6653, 6664, 6667, 6690, 6709, 6713, 6714, 6715, 6716, 6722, 6727, 6728, 6729, 6730, 6731, 6732, 6733, 6734, 6735, 6736, 6738, 6739, 6741, 6743, 6750, 6751, 6755, 6757, 6758, 6759, 6932, 7183

6578 (INIS-GB–374) **The use of an object oriented technique for fault diagnosis in nuclear reactors.** Jalel, N.A.; Nicholson, H. Sheffield Univ. (United Kingdom). Nov 1990 16p. Order Number DE92615105. Source: OSTI; NTIS (US Sales Only); INIS.

In recent years there has been an increased growth of interest in object oriented programming which is a new approach to software construction having wide application. The possibility of using object oriented programming to build a software package that will assist the nuclear reactor operator in diagnosing any faults or alarms in the Loss Of Fluid Test (LOFT), a small scale pressurised water reactor, reactor is investigated in this work. (author).

6579 (INIS-GB–375) **Petri nets and fault diagnosis in nuclear reactors.** Jalel, N.A.; Nicholson, H. Sheffield Univ. (United Kingdom). Nov 1990 18p. (RR–413.). Order Number DE92615106. Source: OSTI; NTIS (US Sales Only); INIS.

The possibility of applying Petri nets (Pns) as a modelling tool to represent any fault or accident that might occur in the Loss Of Fluid Test (LOFT) reactor, small scale pressurised water reactor, is discussed and analysed. Pns are developed to assist the nuclear reactor operator in identifying any fault or alarm that might arise in the power station. (author).

6580 (INIS-GB–376) **The application of neural networks for fault diagnosis in nuclear reactors.** Jalel, N.A.; Nicholson, H. Sheffield Univ. (United Kingdom). Nov 1990 19p. (RR–411.). Order Number DE92615107. Source: OSTI; NTIS (US Sales Only); INIS.

In recent years considerable work have been done in the field of neural networks due to the recent development of effective learning algorithms, and the results of their applications have suggested that they can provide useful tools for solving practical problems. Artificial neural networks are mathematical models of theorized mind and brain activity. They are aimed to explore and reproduce human information processing tasks such as speech, vision, knowledge processing and control. The possibility of using artificial neural networks for fault and accident diagnosis in the Loss Of Fluid Test (LOFT) reactor, a small scale pressurised water reactor, is examined and explained in the paper. (author).

6581 (JAERI-M–91-143) **Analysis of operating experience data in nuclear power plants: Loss of decay heat removal during reactor shutdown.** Watanabe, Norio (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Hirano, Masashi; Oikawa, Tetsukuni. Japan Atomic Energy Research Inst., Tokyo (Japan). Sep 1991. 184p. (In Japanese). Order Number DE92750964. Source: OSTI; NTIS (US Sales Only); INIS.

This report analyzes pressurized water reactor (PWR) and boiling water reactor (BWR) experience involving loss of decay heat removal (DHR) during reactor shutdown. Referring to USNRC's Licensee Event Reports (LERs), OECD/NEA-IRS reports, etc., we selected 206 loss of DHR events which have occurred in PWRs between 1976 and 1990 and 48 events in BWRs between 1985 and 1990. Analysis of 197 events which have occurred in U.S. PWRs indicates that the following direct causes are major contributions resulting in loss of DHR during reactor shutdown: 1) Inadvertent automatic closure of the suction/isolation valves in residual heat removal (RHR) system, 2) RHR pump cavitation due to air entrainment in reduced coolant inventory condition, and 3) Loss of power to RHR pumps. Human factors deficiencies involving procedural inadequacies and personnel errors were identified as the most significant underlying or root causes of the loss of DHR events. Most of the errors were committed during maintenance, testing and repair works. As for 48 events in U.S. BWRs, the leading category of loss DHR events was the inadvertent automatic closure of the suction/isolation valves in RHR system, most of which were caused by human errors. This report describes the above analysis results and presents the events description for the selected significant events. As well, the brief descriptions of the 206 events in PWRs and 48 events in BWRs are provided in Appendix. (author).

6582 (KAERI/RR–946/90) **Study on the computerization of PWR secondary side chemistry monitoring.** Yang, Kyung Rin (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Koo, Je Hyoo; Lee, Eun Hee; Hong, Kwang Bum; Kang, Hee Suck. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1991. 114p. (In Korean). Order Number DE92615108. Source: OSTI; NTIS (US Sales Only); INIS.

Samples of the secondary system in the Yong Gwang 1 Plant were sampled and analysed once a month at 13 sampling points. The main components of materials in the secondary system and corrosion products consisted of iron. Therefore, iron component was used with the index of corrosion products. The weight of iron which was accumulated in the bottom of stea generator can be calculated from the iron concentration and flow rates. That is, the weight of iron which was flowed into the steam generator belonging to the feedwater and the weight of iron which was discharged out from the steam generator was calculated. From these data, the weight of iron which was accumulated in the steam generator was calculated. According to the calculation, it was found that the amount of accumulated iron was 2.01 kg /year for the steam generator A, 1.73 kg /year for the steam generator B and 1.84 kg /year for the steam generator C. (Author).

6583 (KFK–4850, pp. 211-215) **Measurements of turbulent velocity and temperature in a central channel of a heated rod bundle.** Mensinger, E. (Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Neutronenphysik und Reaktortechnik); Meyer, L. Kernforschungszentrum Karlsruhe GmbH (Germany). Projekt Nukleare Sicherheitsforschung. Jul 1991. In *Safety oriented LWR research. Annual report 1990.* 270p. Order Number DE92758922. Source: OSTI; NTIS (US Sales Only); INIS.

A number of experiments has been performed in various rod bundle geometries with isothermal flow. A large number of the available data were acquired in a 4-rod rectangular channel. To model the heated flow correctly a knowledge of turbulent temperature fluctuations such as the eddy diffusivity of heat in all directions is necessary. Since no such data were available for flow through rod bundles, it is the aim to measure the turbulent quantities in heated flow through triangular array rod bundles. The experimental rig was completed last year, all data acquisition and control systems were tested and a first series of measurements were performed. (orig./DG).

6584 (KFK–4850, pp. 216-227) **Investigations in freon on critical heat flux (KRISTA-program).** Erbacher, F.J. (Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Reaktorbauelemente); Cheng, X.; Just, W.; Neitzel, H.J. Kernforschungszentrum Karlsruhe GmbH (Germany). Projekt Nukleare Sicherheitsforschung. Jul 1991. (In German). In *Safety oriented LWR research. Annual report 1990.* 270p. Order Number DE92758922. Source: OSTI; NTIS (US Sales Only); INIS.

An experimental study of CHF in closely spaced 7 rod bundles is performed in the KRISTA test facility. The experiments covered a wide range of parameters of interest to high conversion pressurized water reactors (HCPWR). Under comparable conditions the CHF value in bundles is lower than in tubes. The influence of spacers (grid spacer and wire wrap) on CHF has been found to depend strongly on local steam quality. With regard to the CHF behaviour under HCPWR conditions no noticeable improvement has been achieved in a wire wrapped bundle than in a bundle with grid spacers. (orig.).

6585 (NUREG/CR–5796) **Steam generator operating experience, update for 1989–1990.** Frank, L. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Engineering Technology; Viking Systems International, Pittsburgh, PA (United States). Dec 1991. 113p. Sponsored by Nuclear Regulatory Commission. Source: OSTI; NTIS; INIS; GPO.

This report summarizes operational events and degradation mechanisms affecting pressurized water reactor steam generator integrity. It provides: results of 1989 and 1990 steam generator inspections; highlights prevalent problem areas; improvements that have been made in nondestructive testing methods; preventive measures; repair techniques; and replacement procedures. It describes the equipment of the three (3) major suppliers and discusses recent examinations of 76 plants. Major areas of concern are the steam generator degradation mechanisms that affect tube integrity or cause tube leakage and tube failure. These include; (1) intergranular attack (IGA); (2) intergranular stress corrosion cracking (IGSCC); (3) primary water stress corrosion cracking (PWSCC); (4) pitting; and (5) vibrational wear and fatigue. Also discussed are plugging, sleeving, heat treatment, peening, chemical cleaning, and steam generator replacements. The current status of regulatory instruments and inspection guidelines for ensuring the steam generator integrity, is discussed with the highlights of steam generator research. New potential safety issues such as circumferential cracking and tube plug cracking are also discussed.

6586 (PSI–97) **Advanced LOCA code uncertainty assessment: preliminary calculations for Westinghouse 4 loop PWR.** Coddington, P. (Paul Scherrer Inst. (PSI), Villigen (Switzerland)); Wickett, A.J. Paul Scherrer Inst. (PSI), Villigen (Switzerland). Jun 1991. 68p. Order Number DE92613818. Source: OSTI; NTIS (US Sales Only); INIS.

Three large break LOCA calculations for Sizewell B using TRAC-PF1/MOD1 have been performed. They are: base case, post-dryout heat transfer x 0.5, condensation Stanton number x 0.1. The reduction in post-dryout heat transfer (PDHT) is based on TRAC analysis of LTSF high pressure reflood experiments, PDHT experiments at Winfrith and Harwell and the Winfrith ACHILLES experiment. The reduction in condensation is based on TRAC analysis of refill experiments in a scaled rig at Strathclyde University and comparisons with experimental data in the TRAC models and correlations document. The base case and reduced heat transfer case were compared with other similar calculations. The results were consistent, difference being accounted for qualitatively. The three cases were compared with one another. The resulting peak clad temperatures were: base case: 963 K, post-dryout heat transfer x 0.5: 1113 K, condensation Stanton number x 0.1: 1003 K. The reduction in post-dryout heat transfer worsens cooling during blowdown, increasing the second blowdown peak clad temperature. This higher temperature persists and the reduction in heat transfer further increases the maximum rod temperature, compared with the base case, during reflood. The reduction in condensation reduced the oscillations in core flow during the first 40 seconds of reflood. This in turn appears to have worsened heat transfer resulting in more rapid clad heatup and a higher peak temperature than in the base case. (author) 42 figs., 28 refs.

6587 (SAND–91-7073) **Nuclear reactor pressure vessel flaw distribution development: Phase 2, Methodology and application.** Kennedy, E.L. (Failure Analysis Associates, Inc., Menlo Park, CA (United States)); Foulds, J.R.; Basin, S.L. Sandia National Labs., Albuquerque, NM (United States); Failure Analysis Associates, Inc., Menlo Park, CA (United States). Dec 1991. 103p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC04-76DP00789. Order Number DE92005353. Source: OSTI; NTIS; INIS; GPO Dep.

Previous attempts to develop flaw distributions for probabilistic fracture mechanics analyses of pressurized water reactor (PWR) vessels have aimed at the estimation of a "generic" distribution applicable to all PWR vessels. In contrast, this report describes (1) a new flaw distribution development analytic methodology that can be applied to the analysis of vessel-specific inservice inspection (ISI) data, and (2) results of the application of the methodology to the analysis of flaw data for each vessel case (ISI data on three PWR vessels and laboratory inspection data on sections of the Midland reactor vessel). Results of this study show significant variation among the flaw distributions derived from the various data sets analyzed, strongly suggesting than a vessel-specific flaw distribution (for vessel integrity prediction under pressurized thermal shock) is preferred over a "generic" distribution. In addition, quantitative inspection system flaw sizing accuracy requirements have been identified for developing a flaw distribution from vessel ISI data. The new flaw data analysis methodology also permits quantifying the reliability of the flaw distribution estimate. Included in the report are identified needs for further development of several aspects of ISI data acquisition and vessel integrity prediction practice.

2103 Power Reactors, Nonbreeding, Graphite Moderated

Refer also to citation(s) 6656, 6708, 6725, 6747, 6751, 6928

6588 (ENET–8900340/1) **Developmental work for the steam generators and the NWA-heat exchangers of the HTR-500 reactor.** Bundesamt fuer Energiewirtschaft, Bern (Switzerland). Jun 1990. 19p. (In German). Order Number DE92613830. Source: OSTI; NTIS (US Sales Only); ENET, Elfenauweg 29, CH-3006 Bern (CH).

Within the framework of cooperation in the HTR-500 Project between the IGNT and BBC/HRB Sulzer has completed development work for steam generators and residual heat dissipation heat exchangers. This work lasted over the period from December 1986 to September 1989 and was financed equally by Swiss public funds and Sulzer. The progress of the work was described in detail in regular quarterly reports. The current report gives a summary presentation.

6589 (IWGGCR–25, pp. 139-143) **Fission-gas release during hydrolysis of exposed fuel kernels.** Richards, M.B. (General Atomics, San Diego, CA (United States)); Hanson, D.L.; Turner, R.F. International Atomic Energy Agency, Vienna (Austria). International Working Group on Gas-Cooled Reactors. Nov 1991. (CONF-9011211–: International Atomic Energy Agency (IAEA) specialists meeting on behaviour of gas cooled reactor fuel under accident conditions, Oak Ridge, TN (United States), 5-7 Nov 1990). In *Behaviour of gas cooled reactor fuel under accident conditions: Proceedings of a specialists meeting held in Oak Ridge, 5-8 November 1990.* 164p. Order Number DE92612905. Source: OSTI; NTIS (US Sales Only); INIS.

A potential mechanism for fission-gas release from the Modular High-Temperature Gas-Cooled Reactor (MHTGR) results from the reaction of failed fuel with water vapor during hypothetical accident scenarios. During this reaction, known as fuel hydrolysis, water vapor reacts with the small fraction of exposed fuel kernels to release fission gases that have accumulated in the kernel pore space. Experimental work has been performed to obtain data for quantifying the release of fission products during fuel hydrolysis. The most recent experiments were the irradiations of capsule HRB-17 at Oak Ridge National Laboratory and capsule HFR-B1 at the Petten Establishment in the Netherlands. An analysis of the HRB-17 data has shown that the fractional release of stored fission gases is proportional to approximately the square of the H_2O partial pressure over the range 200 to 2000 μatm. During MHTGR-accident scenarios,(H_2O) partial pressures are expected to be much higher ($\approx$3.5 atm). During the HFR-B1 irradiation, the water-vapor injections covered an expanded range of 200 to 10,600 μatm H_2O. In this paper, a preliminary evaluation of the HFR-B1 data is described. The HFR-B1 data indicate that the fractional release from failed fuel becomes independent of H_2O partial pressure for the range 5000 to 10,000 μatm. This result is consistent with the Langmuir-type mechanism observed in most gas-solid reactions and is also in agreement with previous measurements on unirradiated UC_2 kernels. At high H_2O partial pressures, the fractional release appears to level off at 20-30% of the exposed kernel inventory for reaction times on the order of one day. For typical MHTGR-accident scenarios, the reaction times are expected to be about one hour, and the observed fractional release is less than 0.1%, or more than an order of magnitude below the current model prediction of 6% of exposed kernel inventory.

6590 (IWGGCR–25, pp. 157-162) **In-pile corrosion of grade H-451 graphite by steam.** Richards, M.B. (General Atomics, San Diego, CA (United States)); Gillespie, A.G.; Hanson, D.L. International Atomic Energy Agency, Vienna (Austria). International Working Group on Gas-Cooled Reactors. Nov 1991. (CONF-9011211–: International Atomic Energy Agency (IAEA) specialists meeting on behaviour of gas cooled reactor fuel under accident conditions, Oak Ridge, TN (United States), 5-7 Nov 1990). In *Behaviour of gas cooled reactor fuel under accident conditions: Proceedings of a specialists meeting held in Oak Ridge, 5-8 November 1990.* 164p. Order Number DE92612905. Source: OSTI; NTIS (US Sales Only); INIS.

The fuel elements for the Modular High-Temperature Gas-Cooled Reactor (MHTGR) are to be manufactured from a near-isotropic graphite, such as grade H-451. For economical plant operation, graphite corrosion must not impact the normal fuel-element replacement schedule and must not be the cause of extended reactor-shutdown periods. Graphite corrosion and the potential for increased fission-gas release from fuel hydrolysis are inherently coupled; the water vapor must first penetrate a web of graphite before reaching the fuel compacts that contain the small fraction of failed particles. Hence, graphite corrosion is an important issue for both plant design and safety. In general, previous calculations have not shown good agreement with data obtained from out-of-pile and in-pile experiments that involve both transport and reaction phenomena, unless significant adjustments were made to model parameters, including reaction-rate correlations. The currently used reaction-rate correlations, were developed from out-of-pile data. Under in-pile conditions, radiolysis of water vapor and neutron-induced damage to the graphite may enhance graphite corrosion. The recently completed irradiation of capsule HFR-B1 provided some unique data for in-pile corrosion of H-451 graphite. In this paper, the HFR-B1 graphite-corrosion data are analyzed and compared with model predictions. The calculations were performed using a new corrosion model that previously showed good agreement with burnoff-profile data for out-of-pile corrosion of grade 2020 graphite. Improvements in the new model include a correction in the mass-sink term for steam, and improved models for the burnoff factor and the effective diffusivity of steam in graphite. Predictions obtained suing the new model are also in good agreement with the HFR-B1 data, which indicates that the currently used reaction-rate correlation may be used to predict in-pile corrosion with good accuracy.

6591 (IWGGCR–25, pp. 111-116) **Preliminary safety assessment of the 450 MWT MHTGR.** Dunn, T.D. (General Atomics, San Diego, CA (United States)); Datta, K.; Hoot, C. International Atomic Energy Agency, Vienna (Austria). International Working Group on Gas-Cooled Reactors. Nov 1991. (CONF-9011211–: International Atomic Energy Agency (IAEA) specialists meeting on behaviour of gas cooled reactor fuel under accident conditions, Oak Ridge, TN (United States), 5-7 Nov 1990). In *Behaviour of gas cooled reactor fuel under accident conditions: Proceedings of a specialists meeting held in Oak Ridge, 5-8 November 1990.* 164p. Order Number DE92612905. Source: OSTI; NTIS (US Sales Only); INIS.

The Modular High-Temperature Gas-Cooled Reactor (MHTGR) design has been reevaluated to improve its economic potential. As part of a plant cost reduction study, a range of core designs from the reference 350 MWT design to a maximum of 600 MWT have been studied. Based on an evaluation of key accidents, the recommended 450 MWT MHTGR appears to offer a comparably high level of safety as did the reference 350 MWT plant. The design features of the 450 MWT plant that most impact safety include a larger radionuclide inventory, a larger fueled annular core with its subsequent impact on heat transfer, a core power density about the same as the 350 MWT, and the replacement of fertile thorium fuel with natural uranium. The fissile fuel remains low enriched UCO. These combined design changes result in lower decay heat during accidents than the reference plant. The preliminary 450 MWT safety analysis investigated key design basis conduction cooldown events that included simultaneous loss of all forced cooling and helium coolant. These assessments used a revised accident fuel performance model and a decay heat evaluation specific to the 450 MWT fuel cycle. The fuel performance model used is based on recent FRG fuel sphere heating data that augment the current data base. The limiting MHTGR safety requirement is the Protective Action Guide's preventative thyroid inhalation dose at the Exclusion Area Boundary.

6592 (Juel–2502) **Investigations for the constructive layout and design of a prestressed cast-steel pressure vessel for the HTR-module.** Stoltz, A. Forschungszentrum Juelich GmbH (Germany). Inst. fuer Sicherheitsforschung und Reaktortechnik; Technische Hochschule Aachen (Germany). Jul 1991. 181p. (In German). Order Number DE92750118. Source: OSTI; NTIS (US Sales Only); INIS.

A prestressed cast-steel pressure vessel is developed as bursting-resistant alternative to the conventional steel pressure vessel for the HTR-Module. The lower quality-demands necessary to guarantee the safety are favourable especially for the operation of the prestressed vessel in less industrialized countries. The prestressed reactor pressure vessel is designed methodically and to a great deal dimensioned by existing regulations. A main point is the realization of a prestressing system for the large lateral opening of the tube which connects both vessels for the reactor and steam generator. Investigations of the mechanical stresses inside the carrying components at design conditions and during transient conditions show, that the safety-demands of the nuclear regulation can be fulfilled. Studies concerning the seismic behaviour of an analogous duo-vessel-system give information about a useful design of the vessel bearings. A cost-analysis shows, that the prestressed system is able to compete economically with the steel pressure vessel. Further technical and economical investigations point out potentials for optimizing the vessel system. (orig.).

6593 (ORNL/ER–61) **Annual summary report of the decontamination and decommissioning surveillance and maintenance program at Oak Ridge National Laboratory for period ending September 30, 1991.** Ford, M.K.; Holder, L. Jr. Oak Ridge National Lab., TN (United States). Sep 1991. 9p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC05-84OR21400. Order Number DE92003746. Source: OSTI; NTIS; INIS; GPO Dep.

The Surplus Facilities Management Program and Defense Facilities Decommissioning Program were established at Oak Ridge National Laboratory (ORNL) in 1976 in order to provide collective management of all surplus sites under ORNL control on the Oak Ridge Reservation. Some 34 facilities, classified into 3 civilian-related and 8 defense-related projects, are currently managed by the recently integrated Decontamination and Decommissioning Program. Support includes (1) surveillance and maintenance (S&M) planning, (2) routine S&M, and (3) special maintenance projects. This report documents routine S&M, special projects, and special maintenance performed on these facilities for the period of October 1990 through September 1991.

2104 Power Reactors, Nonbreeding, Otherwise Moderated Or Unmoderated

Refer also to citation(s) 6645, 6751

6594 (ANL/CP–74816) **Application of the successive linear programming technique to the optimum design of a high flux reactor using LEU fuel.** Mo, S.C. Argonne National Lab., IL (United States). [1991]. 12p. Sponsored by U.S. DOE Assistant Secretary for International Affairs and Energy Emergencies. DOE Contract W-31109-ENG-38. (CONF-9111149–1: 14. international meeting on reduced enrichment for research and test reactors, Jakarta (Indonesia), 4-7 Nov 1991). Order Number DE92004139. Source: OSTI; NTIS; INIS; GPO Dep.

The successive linear programming technique is applied to obtain the optimum thermal flux in the reflector region of a high flux reactor using LEU fuel. The design variables are the reactor power, core radius and coolant channel thickness. The constraints are the cycle length, average heat flux and peak/average power density ratio. The characteristics of the optimum solutions with various constraints are discussed.

6595 (LA–12191-M) **CANDU MOX (CMOX) counter design and operation manual.** Menlove, H.O. (Los Alamos National Lab., NM (United States)); Miller, M.C.; Wenz, T.R.; Baca, J.; Kroncke, K.E.; Delegard, C. Los Alamos National Lab., NM (United States). Oct 1991. 31p. Sponsored by U.S. DOE Defense Programs; U.S. Department of Defense. DOE Contract W-7405-ENG-36. (ISPO–336). Order Number DE92002696. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A neutron coincidence counter has been designed to measure the amount of plutonium in the fuel elements or bundles of CANDU reactors. The CANDU MOX counter was designed to have a uniform profile along the length of the bundle. A fuel bundle transfer mechanism was designed to move fuel bundles into and out of the counter. This manual describes the counter hardware, operating characteristics, and calibration.

2105 Power Reactors, Breeding

Refer also to citation(s) 6333, 6645, 6740, 6751

6596 (ANL/CP–69863) **Advanced reactor development: The LMR integral fast reactor program at Argonne.** Till, C.E. Argonne National Lab., IL (United States). [1991]. 4p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. (CONF-911106–14: IEEE nuclear science symposium, Santa Fe, NM (United States), 5-9 Nov 1991). Order Number DE92003310. Source: OSTI; NTIS; INIS; GPO Dep.

Short communication. IFR REACTOR/program management; HISTORICAL ASPECTS; NUCLEAR FUELS; FUEL CYCLE; REACTOR SAFETY; PYROCHEMICAL REPROCESSING; MODIFICATIONS; ELECTROREFINING; PLANNING; RADIOACTIVE WASTE MANAGEMENT

6597 (ANL/CP–73414) **Advanced condition monitoring techniques and plant life extension studies at EBR-2.** Singer, R.M. (Argonne National Lab., IL (United States)); Gross, K.C.; Perry, W.H.; King, R.W. Argonne National Lab., IL (United States). [1991]. 16p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. (CONF-911214–1: International conference on plant life extension (PLEX): upgrading, repair, refurbishment, uprating and ageing, Berlin (Germany), 2-4 Dec 1991). Order Number DE92004150. Source: OSTI; NTIS; INIS; GPO Dep.

Numerous advanced techniques have been evaluated and tested at EBR-2 as part of a plant-life extension program for detection of degradation and other abnormalities in plant systems. Two techniques have been determined to be of considerable assistance in planning for the extended-life operation of EBR-2. The first, a computer-based pattern-recognition system (System State Analyzer or SSA) is used for surveillance of the primary system instrumentation, primary sodium pumps and plant heat balances. This surveillance has indicated that the SSA can detect instrumentation degradation and system performance degradation over varying time intervals and can be used to provide derived signal values to replace signals from failed sensors. The second technique, also a computer-based pattern-recognition system (Sequential Probability Ratio Test or SPRT) is used to validate signals and to detect incipient failures in sensors and components or systems. It is being used on the failed fuel detection system and is experimentally used on the primary coolant pumps. Both techniques are described and experience with their operation presented.

6598 (ANL/CP–73424) **Validation of the REBUS-3/RCT methodologies for EBR-II core-follow analysis.** McKnight, R.D. Argonne National Lab., IL (United States). [1992]. 5p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. (CONF-920308–1: Advances in reactor physics, Charleston, SC (United States), 8-11 Mar 1992). Order Number DE91015138. Source: OSTI; NTIS; INIS; GPO Dep.

One of the many tasks to be completed at EBR-2/FCF (Fuel Cycle Facility) regarding fuel cycle closure for the Integral Fast Reactor (IFR) is to develop and install the systems to be used for fissile material accountancy and control. The IFR fuel cycle and pyrometallurgical process scheme determine the degree of actinide of actinide buildup in the reload fuel assemblies. Inventories of curium, americium and neptunium in the fuel will affect the radiation and thermal environmental conditions at the fuel fabrication stations, the chemistry of reprocessing, and the neutronic performance of the core. Thus, it is important that validated calculational tools be put in place for accurately determining isotopic mass and neutronic inputs to FCF for both operational and material control and accountancy purposes. The primary goal of this work is to validate the REBUS-2/RCT codes as tools which can adequately compute the burnup and isotopic distribution in binary- and ternary-fueled Mark-3, Mark-4, and Mark-5 subassemblies. 6 refs.

6599 (ANL/CP–74230) **Desirable LMR design features: Lessons learned from EBR-II operating experience.** Chang, Y.I. Argonne National Lab., IL (United States). [1991]. 6p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. (CONF-9110153–1: Potential of small nuclear reactors for future clean and safe energy sources, Tokyo (Japan), 23-25 Oct 1991). Order Number DE92003517. Source: OSTI; NTIS; INIS; GPO Dep.

The Experiment Breeder Reactor, EBR-II, has now entered its 28th year of operation. Many years of excellent operating experience have demonstrated the feasibility of conducting routine and special maintenance on sodium systems and components. In general, the concerns earlier expressed for the maintenance, modification, and repair of intrinsically radioactive and sodium-contaminated components have not materialized. This document discusses the experience obtained through these years of operation and the design features of EBR-II. 2 figs.

6600 (ANL/CP–74690) **Status of development and licensing support for advanced liquid metal reactors in the United States.** Pedersen, D.R. (Argonne National Lab., IL (United States)); Gyorey, G. Argonne National Lab., IL (United States). [1991]. 11p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. (CONF-9111128–1: International Atomic Energy conference, Mito (Japan), 5-7 Nov 1991). Order Number DE92003413. Source: OSTI; NTIS; INIS; GPO Dep.

The cornerstones of the United States Advanced Liquid Metal Cooled Reactor (ALMR) program sponsored by the Department of Energy are: the ALMR plant design program at General Electric based on the PRISM (Power Reactor Innovative Small Module) concept, and the Integral Fast Reactor program (IFR) at Argonne National Laboratory (ANL). The goal of the US program is to produce a standard, commercial ALMR, including the associated fuel cycle. The paper addresses the status of the IFR program, the ALMR program and the interaction of the ALMR program with the regulatory environment.

6601 (EUR–13489) **Decontamination between dismantling of the Rapsodie primary coolant circuit.** Costes, J.R. (CEA Etablissement de la Vallee du Rhone, 30 - Bagnols-sur-Ceze (FR)); Gauchon, J.P.; Antoine, P. Commission of the European Communities, Luxembourg (Luxembourg). 1991. 78p. (In French). Contract FI1D-0061. Source: OSTI; NTIS (US Sales Only).

The large-scale decontamination of FBR sodium loops is a novel task, as only a limited number of laboratory-scale results are available to date. The principal objective of this work is to develop a suitable decontamination procedure for application to the primary loops of the RAPSODIE fast breeder reactor as part of decommissionning to Stage 2.

6602 (INIS-mf–13025 vp.) **Plutonium technology in Germany: History and present status (Preprints no. IT-03).** Stoll, Wolfgang. Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. Feb 1991. 685p. (CONF-9102132–: International symposium on radiochemistry and radiation chemistry - plutonium 50, Bombay (India), 4-7 Feb 1991). In *International symposium on radiochemistry and radiation chemistry (Plutonium - 50 years) (held at Bombay during February 4-7, 1991): Preprints volume.* Order Number DE92001334. Source: OSTI; NTIS (US Sales Only); INIS.

Plutonium technology started in Germany in 1964 from Lab scale by fabricating units containing (U,Pu)O_2 for SNEAK-critical assembly in Karlsruhe. Until now a variety of MOX- and FBR-fuel elements have been produced in the Hanau-plant, containing altogether more than 5 tons Pu. (author).

6603 (INIS-mf–13025 vp.) **The in-pile behaviour of plutonium fuels (Preprint no. IT-14).** Mathews, C.K. (Indira Gandhi Centre for Atomic Research, Kalpakkam (India)). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. Feb 1991. 685p. (CONF-9102132–: International symposium on radiochemistry and radiation chemistry - plutonium 50, Bombay (India), 4-7 Feb 1991). In *International symposium on radiochemistry and radiation chemistry (Plutonium - 50 years) (held at Bombay during February 4-7, 1991): Preprints volume.* Order Number DE92001334. Source: OSTI; NTIS (US Sales Only); INIS.

Among the four types of fuels discussed in this paper, the mixed oxide is the best developed. While this fuel may be adequate for the near future, it cannot fully exploit the advantages of the breeder reactor technology. There is enough information available to design a carbide fuel, but for high burn up application much development work is called for. Reprocessing experience is also lacking. There is less data on the nitride fuel, but it appears to be free of some of the disadvantages of the carbide fuel. For example, it dissolves readily in nitric acid and hence is amenable to aqueous reprocessing methods. The nitride fuel is being pursued in Europe. The metallic fuel is actively under development in USA. Its advantages are high breeding gain, passive safety features and short fuel cycle through pyrochemical reprocessing. These features have to be demonstrated in a full fuel cycle before metallic fuels are fully accepted. (author). 36 refs., 5 tabs., 5 figs.

6604 (KFK–4736) **KfK, Institute for Reactor Components. Results of research and development activities in 1989.** Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Reaktorbauelemente. Mar 1990. 25p. (In German). Order Number DE92759306. Source: OSTI; NTIS (US Sales Only); INIS.

R and D activities at IRB (Institut fuer Reaktorbauelemente - Institute for Reactor Components) are dedicated to thermodynamics and fluid dynamics. Emphasis is on the design of nuclear reactor and fusion reactor components. Environmental engineering was added recently. Most activities are applications-oriented. Fundamental investigations focus on energy research and energy technology. The activities are carried out in the framework of different projects (PKF/nuclear fusion, PSF/nuclear safety, PSU/pollution control). Points of main effort are the development of basic liquid-metal-cooled blanket solutions, investigations on natural convection in reactor tanks, and the cooling properties of future containments for pressurized water reactors in the case of nuclear fusion accidents. (orig./GL).

6605 (MIT-ANP-TR–001) **The role of actinide burning and the Integral Fast Reactor in the future of nuclear power.** Hollaway, W.R.; Lidsky, L.M.; Miller, M.M. Massachusetts Inst. of Tech., Cambridge, MA (United States). Dept. of Nuclear Engineering. Dec 1990. 162p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-76OR00033 ;W-31109-ENG-38. Order Number DE92004771. Source: OSTI; NTIS; INIS; GPO Dep.

A preliminary assessment is made of the potential role of actinide burning and the Integral Fast Reactor (IFR) in the future of nuclear power. The development of a usable actinide burning strategy could be an important factor in the acceptance and implementation of a next generation of nuclear power. First, the need for nuclear generating capacity is established through the analysis of energy and electricity demand forecasting models which cover the spectrum of bias from anti-nuclear to pro-nuclear. The analyses take into account the issues of global warming and the potential for technological advances in energy efficiency. We conclude, as do many others, that there will almost certainly be a need for substantial nuclear power capacity in the 2000–2030 time frame. We point out also that any reprocessing scheme will open up proliferation-related questions which can only be assessed in very specific contexts. The focus of this report is on the fuel cycle impacts of actinide burning. Scenarios are developed for the deployment of future nuclear generating capacity which exploit the advantages of actinide partitioning and actinide burning. Three alternative reactor designs are utilized in these future scenarios: The Light Water Reactor (LWR); the Modular Gas-Cooled Reactor (MGR); and the Integral Fast Reactor (FR). Each of these alternative reactor designs is described in some detail, with specific emphasis on their spent fuel streams and the back-end of the nuclear fuel cycle. Four separation and partitioning processes are utilized in building the future nuclear power scenarios: Thermal reactor spent fuel preprocessing to reduce the ceramic oxide spent fuel to metallic form, the conventional PUREX process, the TRUEX process, and pyrometallurgical reprocessing.

2106 Power Reactors, Mobile, Propulsion, Package, and Transportable

6606 (EGG-M-91428) **Cost effective development of a nuclear thermal rocket engine (NTRE).** Leyse, C.F. (Leyse (C.F.), Idaho Falls, ID (United States)); Ramsthaler, J.H.; Culver, D.W.; Haloulakos, V.E. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1991]. 11p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-9109226-25: AIAA/NASA/OAI conference on advanced space exploration initiative (SEI) technologies, Cleveland, OH (United States), 3-4 Sep 1991). Order Number DE92003320. Source: OSTI; NTIS (US Sales Only); GPO Dep.

It is proposed that the development of a small, low thrust engine is a cost effective approach to the development of an NTRE and that an early version of such an engine could be available for a flight test program by the year 2000. The development of a low thrust (e.g. 2000-5000 lbf engine can utilize existing, upgraded and modified development and test facilities, thus avoiding the large up-from cost of the very large facilities required for testing high thrust (e.g. $\geq$ 75,000 lbf) NTREs. Near term (T_c= 2500 K) and advanced T_c= 32000 K) versions of a high pressure (P_c = 500 psia) and a low pressure (P_c = 50 psia) NTRE are described and mission performance evaluated for a typical space mission involving the potential payload to GEO assuming a Titan IV launch of 40 klbm to LEO. Potential payloads of the advanced engine are approximately 50% greater than the payload of high performance LOX-hydrogen chemical engines. The low pressure engine is indicated to out-perform the high pressure concept. Clustering of eight to sixteen 5000 lbf thrust engines may be feasible and would provide sufficient thrust for human missions to Mars, thereby eliminating the costly and time consuming development of a high thrust NTRE. Considering the differences in costs of test facilities, test engines, engine ground and flight testing and deployment date, the low thrust engine could result in savings of several billions dollars compared to development of a high (e.g. 75,000 lbf) engine. 8 refs., 11 figs., 5 tabs.

6607 (EGG-M-91485) **Comet Riders-Nuclear nomads to the stars.** Angelo, J.A. Jr. (Science Applications International Corp., Melbourne, FL (United States)); Buden, D. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1991]. 7p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-9110217-5: 42. International Aeronautical Federation Congress (IAEFC), Montreal (Canada), 7-11 Oct 1991). Order Number DE92003287. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes the potential role of an evolutionary family of advanced space nuclear power systems (solid core reactor, gas core reactor, and thermonulcear fusion systems) in the detailed exploration of Solar System comets and in the use of interstellar comes to support migratory journeys to the stars by both human beings and their smart robot systems. 14 refs., 5 figs., 2 tabs.

6608 (LA-UR-91-2434) **Critical experiments and reactor testing in support of the Rover Program.** Paternoster, R.R.; Kirk, W.L. Los Alamos National Lab., NM (United States). [1991]. 10p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-9109226-22: AIAA/NASA/OAI conference on advanced space exploration initiative (SEI) technologies, Cleveland, OH (United States), 3-4 Sep 1991). Order Number DE92002514. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The Los Alamos Critical Experiments Facility (LACEF) played a central role in the Rover design and development process. This paper illustrates the iterative nuclear design and development process used during the Rover space nuclear reactor propulsion program and reviews the role played by critical experiments performed at the LACEF. 13 refs., 5 figs., 1 tab.

6609 (SAND-91-2315C) **Nuclear Thermal Propulsion test facility requirements and development strategy.** Allen, G.C. (Sandia National Labs., Albuquerque, NM (United States)); Warren, J.; Clark, J.S.; Perkins, D.R.; Martinell, J. Sandia National Labs., Albuquerque, NM (United States). 18 Oct 1991. 12p. Sponsored by U.S. DOE Nuclear Energy; U.S. Department of Defense; National Aeronautics and Space Administration. DOE Contract AC04-76DP00789. (CONF-920104-18: 9. symposium on space nuclear power systems, Albuquerque, NM (United States), 13-16 Jan 1992). Order Number DE92002923. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The Nuclear Thermal Propulsion (NTP) subpanel of the Space Nuclear Propulsion Test Facilities Panel evaluated facility requirements and strategies for nuclear thermal propulsion systems development. High pressure, solid core concepts were considered as the baseline for the evaluation, with low pressure concepts an alternative. The work of the NTP subpanel revealed that a wealth of facilities already exists to support NTP development, and that only a few new facilities must be constructed. Some modifications to existing facilities will be required. Present funding emphasis should be on long-lead-time items for the major new ground test facility complex and on facilities supporting nuclear fuel development, not hydrogen flow test facilities, and low power critical facilities.

6610 (WHC-SA-1402) **Nuclear electric propulsion development and qualification facilities.** Dutt, D.S. (Westinghouse Hanford Co., Richland, WA (United States)); Thomassen, K.; Sovey, J.; Fontana, M. Westinghouse Hanford Co., Richland, WA (United States). Nov 1991. 11p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-87RL10930. (CONF-920104-23: 9. symposium on space nuclear power systems, Albuquerque, NM (United States), 13-16 Jan 1992). Order Number DE92004262. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This paper summarizes the findings of a Tri-Agency panel; consisting of members from the National Aeronautics and Space Administration (NASA), US Department of Energy (DOE), and US Department of Defense (DOD); charged with reviewing the status and availability of facilities to test components and subsystems for megawatt-class nuclear electric propulsion (NEP) systems. The facilities required to support development of NEP are available in NASA centers, DOE laboratories, and industry. However, several key facilities require significant and near-term modification in order to perform the testing required to meet a 2014 launch date. For the higher powered Mars cargo and piloted missions, the priority established for facility preparation is: (1) thruster developmental testing facility, (2) thruster lifetime testing facility, (3) dynamic energy conversion development and demonstration facility, and (4) advanced reactor testing facility (if required to demonstrate an advanced multiwatt power system). Facilities to support development of the power conditioning and heat rejection subsystems are available in industry, federal laboratories, and universities. In addition to the development facilities, a new preflight qualifications and acceptance testing facility will be required to support the deployment of NEP systems for precursor, cargo, or piloted Mars missions. Because the deployment strategy for NEP involves early demonstration missions, the demonstration of the SP-100 power system is needed by the early 2000s.

2107 Regulation and Licensing

Refer also to citation(s) 6600, 6674, 6712, 6741, 6742, 6744

6611 (INIS-GB-389) **Licensing reform in the USA: A review.** ERC Environmental and Energy Services Co., Fairfax, VA (United States). Jan 1991 229p. Order Number DE92615175. Source: OSTI; NTIS (US Sales Only); INIS.

The licensing process for nuclear power plants in the USA is currently in two distinct stages: the issuance of a construction permit followed later by the issuance of an operation license. The "two-step" process has come under heavy criticism from the U.S. nuclear industry on the grounds that it causes uncertainty and delays and therefore inhibits new commitments to nuclear power plants. In 1989 the NRC published new regulations for the licensing of nuclear power plants which provide for the issuance of early site permits, safety certifications of standard designs, and combined construction permits and operating licences. The new rule was challenged by intervenors representing antinuclear groups who filed a legal challenge seeking to have the rule set aside on the grounds that it violates the Atomic Energy Act which they allege makes two-step licensing mandatory. In November 1990 the US Court of Appeals upheld the NRC's authority to issue combined licenses. An appeal for a rehearing has been filed. The paper analyses the events and the possible consequences of an adverse court decision. It reviews the options open to the NRC and industry if the court decision is upheld. The possibility of congressional action to amend the Atomic Energy Act is discussed. (author).

6612 (NUREG–0304-Vol.16-No.2) **Regulatory and technical reports (abstract index journal): Compilation for second quarter 1991, April–June: Volume 16, No. 2.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Freedom of Information and Publications Services. Nov 1991. 44p. Sponsored by Nuclear Regulatory Commission. Source: OSTI; NTIS; INIS; GPO.

This journal includes all formal reports in the NUREG series prepared by the NRC staff and contractors; proceedings of conferences and workshops; as well as international agreement reports. The entries in this compilation are indexed for access by title and abstract, secondary report number, personal author, subject, NRC organization for staff and international agreements, contractor, international organization, and licensed facility.

6613 (NUREG–0750-Vol.34-No.3) **Nuclear Regulatory Commission issuances: Volume 43, No. 3.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Freedom of Information and Publications Services. Sep 1991. 52p. Sponsored by Nuclear Regulatory Commission. Source: OSTI; NTIS; INIS; GPO.

This report includes the issuances received during the specified period from the Commission (CLI), the Atomic Safety and Licensing Boards (LBP), the Administrative Law Judges (ALJ), the Directors' Decisions (DD), and the Denials of Petitions for Rulemaking (DPRM).

6614 (NUREG–0750-Vol.34-No.4) **Nuclear Regulatory Commission issuances: Volume 34, No. 4.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Freedom of Information and Publications Services. Oct 1991. 36p. Sponsored by Nuclear Regulatory Commission. Source: OSTI; NTIS; INIS; GPO.

This report includes the issuances received during the specified period from the Commission (CLI), the Atomic Safety and Licensing Boards (LBP), the Administrative Law Judges (ALJ), the Directors' Decisions (DD), and the Denials of Petitions for Rulemaking (DPRM).

6615 (NUREG–0936-Vol.10-No.3) **NRC Regulatory Agenda: Quarterly report, July–September 1991: Volume 10, No. 3.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Freedom of Information and Publications Services. Oct 1991. 124p. Sponsored by Nuclear Regulatory Commission. Source: OSTI; NTIS; INIS; GPO.

The NRC Regulatory Agenda is a compilation of all rules on which the NRC has recently completed action, or has proposed action, or is considering action, and all petitions for rulemaking which have been received by the Commission and are pending disposition by the Commission. The Regulatory Agenda is updated and issued each quarter.

6616 (NUREG–0940-Vol.10-No.3) **Enforcement actions: Significant actions resolved: Quarterly progress report, July–September 1991: Volume. 10, No. 3.** Nuclear Regulatory Commission, Washington, DC (United States). Office of Enforcement. Nov 1991. 215p. Sponsored by Nuclear Regulatory Commission. Source: OSTI; NTIS; INIS; GPO.

This compilation summarizes significant enforcement actions that have been resolved during one quarterly period (July–September 1991) and includes copies of letters, Notices, and Orders sent by the Nuclear Regulatory Commission to licensees with respect to these enforcement actions. It is anticipated that the information in this publication will be widely disseminated to managers and employees engaged in activities licensed by the NRC, so that actions can be taken to improve safety by avoiding future violations similar to those described in this publication.

6617 (NUREG–1362) **Regulatory analysis for final rule on nuclear power plant license renewal: Final report.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Safety Issue Resolution. Dec 1991. 190p. Sponsored by Nuclear Regulatory Commission. Source: OSTI; NTIS; INIS; GPO.

This regulatory analysis provides the supporting information for the final rule (10 CFR Part 54) that defines the Nuclear Regulatory Commission's requirements for renewing the operating licenses of commercial nuclear power plants. A set of four specific alternatives for the safety review of license renewal applications is defined and evaluated. These are: Alternative A-current licensing basis; Alternative B-extension of Alternative A to require assessment and managing of aging; Alternative C – extension of Alternative B to require assessment of design differences against selected new-plant standards using probabilistic risk assessment; and Alternative D – extension of Alternative B to require compliance with all new-plant standards. A quantitative comparison of the four alternatives in terms of impact-to-value ratio is presented, and Alternative B is the most cost-beneficial safety review alternative.

6618 (NUREG–1363-Vol.3) **Atomic Safety and Licensing Board Panel annual report: Fiscal year 1990: Volume 3.** Nuclear Regulatory Commission, Washington, DC (United States). Sep 1991. 24p. Sponsored by Nuclear Regulatory Commission. Source: OSTI; NTIS; INIS; GPO.

In Fiscal Year 1990, The Atomic Safety and Licensing Board Panel (Panel) handled 40 proceedings involving the construction, operation, and maintenance of commercial nuclear power reactors or other activities requiring a license from the Nuclear Regulatory Commission. This report summarizes, highlights, and analyzes how the judges and licensing boards of the Panel addressed the wide-ranging issues raised in these proceedings during the year.

6619 (NUREG–1398) **Environmental assessment for final rule on nuclear power plant license renewal: Final report.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Safety Issue Resolution. Dec 1991. 47p. Sponsored by Nuclear Regulatory Commission. Source: OSTI; NTIS; INIS; GPO.

The Atomic Energy Act and Nuclear Regulatory Commission (NRC) regulations provide for the renewal of nuclear power plant operating licenses beyond their initial 40-year term. The Act and NRC regulations, however, do not specify the procedures, criteria, and standards that must be satisfied in order to renew a license. The NRC is promulgating a rule (10 CFR Part 54) to codify such requirements prior to the receipt of applications for license renewal. The NRC has assessed the possible environmental effects of promulgating requirements in 10 CFR Part 54 now rather than employing such requirements in an ad hoc manner in individual licensing actions. The final part 54 rule requires the development of information and analyses to identify aging problems of systems, structures, and components unique to license renewal that will be of concern during the period of extended operation and will not be controlled by existing effective programs. In general, licensee activities for license renewal may involve replacement, refurbishment, inspection, testing, or monitoring. Such actions will be generally be within the range of similar actions taken for plants during the initial operating term. These actions would be primarily confined within the plants with potential for only minor disruption to the environment. It is unlikely that these actions would change the operating conditions of plants in ways that would change the environmental effects already being experienced. Relicensing under existing regulations would also be primarily focused on aging degradation and would likely result in requirements similar to those that will result from relicensing under the final rule.

6620 (NUREG–1412) **Foundation for the adequacy of the licensing bases: A supplement to the statement of considerations for the rule on nuclear power plant license renewal (10 CFR Part 54): Final report.** Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Reactor Regulation. Dec 1991. 109p. Sponsored by Nuclear Regulatory Commission. Source: OSTI; NTIS; INIS; GPO.

The objective of this report is to describe the regulatory processes that assures that any plant-specific licensing bases will provide reasonable assurance that the operation of nuclear power plants will not be inimical to the public health and safety to the end of the renewal period. It is on the adequacy of this process that the Commission has determined that a formal renewal licensing review against the full range of current safety requirements would not add significantly to safety and is not needed to assure that continued operation throughout the renewal term is not inimical to the public health and safety or common defense and security. This document illustrates in general terms how the regulatory process has evolved in major safety issue areas. It also provides examples illustrating why it is unnecessary to re-review an operating plant's basis, except for age-related degradation unique to license renewal, at the time of license renewal. The report is a supplement to the Statement of Considerations for the Nuclear Regulatory Commission's rule (10 CFR Part 54) that established the criteria and standards governing nuclear power plant license renewal.

6621 (NUREG–1428) **Analysis of public comments on the proposed rule on nuclear power plant license renewal.** Nuclear Regulatory Commission, Washington, DC (United States). Div. of Safety Issue Resolution. Dec 1991. 360p. Sponsored by Nuclear Regulatory Commission. Source: OSTI; NTIS; INIS; GPO.

This report provides a summary and analysis of public comments on the proposed license renewal rule for the nuclear power plants (10 CFR Part 54) published in the Federal Register on 17 July 1990. It also documents the NRC's resolution of the issues raised by the commenters. Comments from 121 organizations and 76 individuals were reviewed and analyzed to identify the issues, including those pertaining to the adequacy of the licensing basis, the performance of an integrated plant assessment, backfit considerations, and need for public hearings. The analysis included grouping of commenters' views according to the issues raised. The public comments analyzed in this report were taken into consideration in the development of the final rule and revisions to the supporting documents.

6622 (NUREG/CR–2000-Vol.10-No.9) **Licensee Event Report (LER) compilation for month of September 1991.** Nuclear Regulatory Commission, Washington, DC (United States). Office for Analysis and Evaluation of Operational Data; Oak Ridge National Lab., TN (United States). Nuclear Operations Analysis Center. Oct 1991. 87p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. (ORNL/NSIC–200-Vol.10-No.9). Source: OSTI; NTIS; INIS.

This monthly report contains Licensee Event Report (LER) operational information that was processed into the LER data file of the Nuclear Safety Information Center (NSIC) during the one month period identified on the cover of the document. The LERs, from which this information is derived, are submitted to the Nuclear Regulatory Commission (NRC) by nuclear power plant licensees in accordance with federal regulations. Procedures for LER reporting for revisions to those events occurring prior to 1984 are described in NRC Regulatory Guide 1.16 and NUREG-0161, Instructions for Preparation of Data Entry Sheets for Licensee Event Reports. For these events occurring on and after January 1, 1984, LERs are being submitted in accordance with the revised rule contained in Title 10 Part 50.73 of the Code of Federal Regulations (10 CFR 50.73 – Licensee Event Report System) which was published in the Federal Register (Vol. 48, No. 144) on July 26, 1983. NUREG-1022, Licensee Event Report System – Description of Systems and Guidelines for Reporting, provides supporting guidance and information on the revised LER rule. The LER summaries in this report are arranged alphabetically by facility name and then chronologically by event data for each facility. Component, system, keyword, and component vendor indexes follow the summaries. Vendors are those identified by the utility when the LER form is initiated; the keywords for the component, system, and general keyword indexes are assigned by the computer using correlation tables from the Sequence Coding and Search System.

6623 (NUREG/CR–2000-Vol.10-No.10) **Licensee Event Report (LER) compilation for the month of October 1991: Volume 10, No.10.** Oak Ridge National Lab., TN (United States); Nuclear Regulatory Commission, Washington, DC (United States). Office for Analysis and Evaluation of Operational Data. Nov 1991. 138p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. (ORNL/NSIC–200-Vol.10-No.10). Source: OSTI; NTIS; INIS; GPO.

This monthly report contains Licensee Event Report (LER) operational information that was processed into the LER data file of the Nuclear Safety Information Center (NSIC) during the one month period identified on the cover of the document. The LERs, from which this information is derived, are submitted to the Nuclear Regulatory Commission (NRC) by nuclear power plant licensees in accordance with federal regulations. Procedures for LER reporting for revisions to those events occurring prior to 1984 are described in NRC Regulatory Guide 1.16 and NUREG-0161, Instructions for Preparation of Data Entry Sheets for Licensee Event Reports. For those events occurring on and after January 1, 1984, LERs are being submitted in accordance with the revised rule contained in Title 10 Part 50.73 of the Code of Federal Regulations (10 CFR 50.73 – Licensee Event Report System) which was published in the Federal Register (Vol. 48, No. 144) on July 26, 1983. NUREG-1022, Licensee Event Report System – Description of Systems and Guidelines for Reporting, provides supporting guidance and information on the revised LER rule. The LER summaries in this report are arranged alphabetically by facility name and then chronologically by event date for each facility. Component, system, keyword, and component vendor indexes follow the summaries. Vendors are those identified by the utility when the LER form is initiated; the keywords for the component, system, and general keyword indexes are assigned by the computer using correlation tables from the Sequence Coding and Search System.

6624 (WHC-SA–1266-Rev.1) **Resolving the problem of compliance with the ever increasing and changing regulations: Revision 1.** Leigh, H. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 8p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-87RL10930. (CONF-920104–3-Rev.1: 9. symposium on space nuclear power systems, Albuquerque, NM (United States), 13-16 Jan 1992). Order Number DE92003629. Source: OSTI; NTIS; INIS; GPO Dep.

The most common problem identified at several US Department of Energy (DOE) sites is regulatory compliance. Simply, the project viability depends on identifying regulatory requirements at the beginning of a specific project to avoid possible delays and cost overruns. The Radioisotope Power Systems Facility (RPSF) is using the Regulatory Compliance System (RCS) to deal with the problem that well over 1000 regulatory documents had to reviewed for possible compliance requirements applicable to the facility. This overwhelming number of possible documents is not atypical of all DOE facilities thus far reviewed using the RCS system. The RCS was developed to provide control and tracking of all the regulatory and institutional requirements on a given project. WASTREN, Inc., developed the RCS through various DOE contracts and continues to enhance and update the system for existing and new contracts. The RCS provides the information to allow the technical expert to assimilate and manage accurate resource information, compile the necessary checklists, and document that the project or facility fulfills all of the appropriate regulatory requirements. The RCS provides on-line information, including status throughout the project life, thereby allowing more intelligent and proactive decision making. Also, consistency and traceability are provided for regulatory compliance documentation. 1 ref., 1 fig.

2108 Economics

Refer also to citation(s) 6476, 6598, 6605, 6801, 6808, 6823

6625 (KAERI/RR–947/90) **Economic analysis of nuclear power generation.** Lee, Young Gun (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Song, Ki Dong; Lee, Man Ki; Chung, Whan Sam; Kim, Seung Su; Moon, Kee Hwan; Kim, Kyoung Pyo; Cho, Sang Goo. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Feb 1991. 115p. (In Korean). Order Number DE92615166. Source: OSTI; NTIS (US Sales Only); INIS.

Nuclear power occupies about 50% of the total power generation and it will still play a crucial role in the future in Korea. The purpose of this study is to confirm importance of the role of nuclear power generation in energy self-reliance by suggesting an optimal plant mix through consistent and systematic derivation of data on electricity power plant. This study explores the effect of standardization of nuclear power plants in Korea and its influence on long-term electric system expansion planning(ESEP). Efforts are made to improve the applications of methodologies and to clarify some important concepts currently using in ESEP. And it is suggested to lower 8% of real discount rate, which is used currently, in order to reflect risk-free investment of electricity business. (Author).

2109 Process Heat Reactors

6626 (KAERI/RR–975/90) **The development status and survey of the technical data for nuclear district heating reactors.** Kwack, Eun Ho (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Lee, Jeong Young; Lee, Jae Han; Lee, Hyong Yeun; Koo, Gyeong Hoi. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Feb 1991. 105p. (In Korean). Order Number DE92615035. Source: OSTI; NTIS (US Sales Only); INIS.

The objective of the study presented is to reserve the basis for the design and construction of a 10MWt NDHR in KAERI site after surveying and analyzing the development status and the technical data for the NDHR under operation and development in the world. The results of the study are that the verification tests of the performance and the safety for the components and systems composing the reactor are required because the NDHR, for the most part, are under development stage except some reactors. Concerning with the design and construction of a NDHR in Korea, it seems to be desirable that the selection of the reactor and the co-work with a foreign country should be performed after reviewing the technical characteristics, safety, economy and the possibility of domestic production of NDHR in depth. Additionally as the regulation and licensing for the NDHR are not established yet except for some countries, it is required that the work concerning with the regulation and licensing should be performed at the sometime. (Author).

22 NUCLEAR REACTOR TECHNOLOGY

Refer also to citation(s) 6793, 7037

6627 (FASAC-TAR-92003807) **West European nuclear power generation research and development.** Turinsky, P.J.; Baron, S.; Burch, W.D.; Corradini, M.L.; Lucas, G.E.; Matthews, R.B.; Uhrig, R.E. Science Applications International Corp., McLean, VA (United States). Foreign Applied Sciences Assessment Center. Sep 1991. 364p. Source: OSTI; Science Applications International Corp., 1710 Goodridge Dr., P.O. Box 1303, McLean, VA 22102.

This report assesses the status of West European research and development (R&D) in support of nuclear power generation. The focus is on light-water reactors (LWRs), as they will likely be the only concept commerically implemented within the next decade. To a laser degree, alternative concepts such as the high-temperature gas cooled reactor and the liquid-metal reactor (LMR) are also assessed. To bound the study, only the fuel cycle stages of fuel fabrication, power generation, and fuel reprocessing are considered. Under the topic of power generation, the subtopics of core reactor physics, materials, instrumentation and control systems, nuclear power safety, and power plant fabrication and construction are addressed. The front-end fuel cycle stages of mining and milling, conversion and enrichment, and the back-end fuel cycle stages of waste conditioning and disposal and not considered. Most assessments for light-water reactor R&D are completed on a country-by-country basis since there is limited cooperation among the West European countries due to the commercial relevance of R&D in this area.

2201 Theory and Calculation

Refer also to citation(s) 6598, 6673, 6699, 6728, 8122

6628 (CTA-IEAV-NT–006/91) **Extension of the Th-232 burnup chain in the WIMSD/4 program library.** Caldeira, A.D. Centro Tecnico Aeroespacial (CTA-IEAv), Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados. Jul 1991. 11p. (In Portuguese). Order Number DE92613776. Source: OSTI; NTIS (US Sales Only); INIS.

The Th-232 burnup chain was extended through U-236, in the WIMSD/4 program library. The evolution of the values of $k_i$nf and U-235 number density, as function of time, for the modified TRX1 problem, calculated with the new library, shows an improvement in the results when compared with LEOPARD program. (author).

6629 (DOE/ER/12888–T1) **A semi-experimental nodal synthesis method for the on-line reconstruction of three-dimensional neutron flux-shapes and reactivity: Final report.** Jacqmin, R.P. Massachusetts Inst. of Tech., Cambridge, MA (United States). Dept. of Nuclear Engineering. 10 Dec 1991. 529p. Sponsored by U.S. DOE Energy Research. DOE Contract FG07-89ER12888. Order Number DE92004450. Source: OSTI; NTIS; INIS; GPO Dep.

The safety and optimal performance of large, commercial, light-water reactors require the knowledge at all time of the neutron-flux distribution in the core. In principle, this information can be obtained by solving the time-dependent neutron diffusion equations. However, this approach is complicated and very expensive. Sufficiently accurate, real-time calculations (time scale of approximately one second) are not yet possible on desktop computers, even with fast-running, nodal kinetics codes. A semi-experimental, nodal synthesis method which avoids the solution of the time-dependent, neutron diffusion equations is described. The essential idea of this method is to approximate instantaneous nodal group-fluxes by a linear combination of K, precomputed, three-dimensional, static expansion-functions. The time-dependent coefficients of the combination are found from the requirement that the reconstructed flux-distribution agree in a least-squares sense with the readings of J ($\geq$K) fixed, prompt-responding neutron-detectors. Possible numerical difficulties with the least-squares solution of the ill-conditioned, J-by-K system of equations are brought under complete control by the use of a singular-value-decomposition technique. This procedure amounts to the rearrangement of the original, linear combination of K expansion functions into an equivalent more convenient, linear combination of R ($\leq$K) orthogonalized "modes" of decreasing magnitude. Exceedingly small modes are zeroed to eliminate any risk of roundoff-error amplification, and to assure consistency with the limited accuracy of the data. Additional modes are zeroed when it is desirable to limit the sensitivity of the results to measurement noise.

6630 (EGG-M–91053) **Desk top calculation strategies for reactor analysis using Mathematica.** Kullberg, C. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1991]. 4p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC07-76ID01570. (CONF-911107–44: Winter meeting of the American Nuclear Society (ANS), San Francisco, CA (United States), 10-15 Nov 1991). Order Number DE92003300. Source: OSTI; NTIS; INIS; GPO Dep.

Mathematics is one of several recently developed equations analysis programs that is particularly well suited for solving a broad range of intermediate engineering problems. The objective of this paper is to demonstrate, using a couple of reactor-related examples, how Mathematica can be exploited as a user-friendly analysis tool to symbolically and numerically handle systems of algebraic and differential equations. 7 refs., 3 figs.

6631 (INIS-BR–2880) **A neutron diffusion model for a fluidized bed nuclear reactor.** Vilhena, M.T. de (Rio Grande do Sul Univ., Porto Alegre, RS (Brazil). Dept. de Engenharia Nuclear); Claeyssen, J.R. Sociedade Brasileira de Matematica Aplicada e Computacional, Rio de Janeiro, RJ (Brazil). 1989 3p. (In Portuguese). (CONF-8909464–: 12. Brazilian congress of applied computational mathematics, Sao Jose do Rio Preto (Brazil), 4-8 Sep 1989). Order Number DE92615087. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. FLUIDIZED BED REACTORS/neutron diffusion equation; FLUIDIZED BED REACTORS/reactor kinetics equations; DELAYED NEUTRONS; NEUTRON TRANSPORT THEORY; PROMPT NEUTRONS

6632 (KFK–4850, pp. 179-210) **Development of calculational procedures for the neutron physics design of an APWR equilibrium core.** Broeders, C.H.M. (Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Neutronenphysik und Reaktortechnik). Kernforschungszentrum Karlsruhe GmbH (Germany). Projekt Nukleare Sicherheitsforschung. Jul 1991. (In German). In *Safety oriented LWR research. Annual report 1990.* 270p. Order Number DE92758922. Source: OSTI; NTIS (US Sales Only); INIS.

The development of calculational procedures for the neutron physics design of an APWR equilibrium core with tight triangular fuel lattice is described. In the first section problems related to the following topics are discussed: calculation of infinite reactor zones, fuel depletion and burnup, reactor control, calculation of the fuel assemblies, calculation of the whole core and preparation and validation of data libraries. In the last section a new procedure with related libraries is presented. This program, ARCOSI, allows the simulation of an APWR-Core during an arbitrary number of cycles, including fuel assembly shuffling. (orig./DG).

6633 (KFK–4850, pp. 167-178) **On the analysis of LWHCR experiments performed in PROTEUS.** Boehme, R. (Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Neutronenphysik und Reaktortechnik). Kernforschungszentrum Karlsruhe GmbH (Germany). Projekt Nukleare Sicherheitsforschung. Jul 1991. (In German). In *Safety oriented LWR research. Annual report 1990.* 270p. Order Number DE92758922. Source: OSTI; NTIS (US Sales Only); INIS.

The experiments for the investigation of the physics of a Light Water High Conversion Reactor (LWHCR) at the PROTEUS reactor facility in Switzerland was terminated at the end of 1990. For the comparison - with results of cell calculations - of reaction rate ratios and k_∞ measured in these LWHCR lattice experiments, a number of correction factors was calculated using data and methods available at KfK. The calculation of correction factors for PROTEUS experiments is described and some results of cell calculations are compared with measured reaction rate ratios and k_∞. It is shown that k_∞ values of most LWHCR lattices can be predicted within the experimental error limit using codes and nuclear data developed at KfK for LWHCR studies. Larger discrepancies still exist between calculated and measured reaction rate ratios. (orig./DG).

6634 (PSI–107) **EFF1LIB: a NJOY generated neutron data library based on EFF-1 for the continuous energy Monte Carlo code MCNP.** Vontobel, P. (Paul Scherrer Inst. (PSI), Villigen (Switzerland)). Paul Scherrer Inst. (PSI), Villigen (Switzerland). Sep 1991. 50p. Order Number DE92613777. Source: OSTI; NTIS (US Sales Only); INIS.

EFF1LIB is a fast neutron data library for the Los Alamos continuous energy Monte Carlo Code MCNP. The library contains cross section data for 69 - light and structural material - isotopes mainly from the EFF-1 evaluation in the energy range 10^{-5} EV to 20 MeV. Isotopes of the following chemical elements are included: H, He, Li, Be, B, C, N, O, F, Na, Mg, Al, Si, P, S, Cl, Ar, K, Ca, Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zr, Nb, Mo, Ag, Cd, In, Sn, Xe, Cs, Ba, Sm, Hf, Ta, W, Pb and Bi. An index to this library together with plots of the total cross sections and the local prompt neutron heating values is presented. The generation of the library wigh NJOY is described. (author) figs., 3 tabs., 9 refs.

6635 (WHC-EP–0435) **1DB, a one-dimensional diffusion code for nuclear reactor analysis.** Little, W.W. Jr. (Pacific Northwest Lab., Richland, WA (United States)). Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 102p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-87RL10930. Order Number DE92003020. Source: OSTI; NTIS; INIS; GPO Dep.

1DB is a multipurpose, one-dimensional (plane, cylinder, sphere) diffusion theory code for use in reactor analysis. The code is designed to do the following: To compute k_{eff} and perform criticality searches on time absorption, reactor composition, reactor dimensions, and buckling by means of either a flux or an adjoint model; to compute collapsed microscopic and macroscopic cross sections averaged over the spectrum in any specified zone; to compute resonance-shielded cross sections using data in the shielding factor format; and to compute isotopic burnup using decay chains specified by the user. All programming is in FORTRAN. Because variable dimensioning is employed, no simple restrictions on problem complexity can be stated. The number of spatial mesh points, energy groups, upscattering terms, etc. is limited only by the available memory. The source file contains about 3000 cards. 4 refs.

2202 Components and Accessories

Refer also to citation(s) 6604, 6659, 6707, 6748, 6753, 6754, 7149, 8397

6636 (BNL–46745) **Locating of leaks in water-cooled generator stator bars using perfluorocarbon tracers.** Loss, W.M.; Dietz, R.N. Brookhaven National Lab., Upton, NY (United States). Sep 1991. 36p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE92005006. Source: OSTI; NTIS; GPO Dep.

Water cooled stator bars in power plant generators often fail during the maintenance cycle due to water leakage. After the hydrogen pressure in the generator shell has been released water can leak through cracks in the copper and through the insulation. Leaking bars, but not the leaks themselves, are detected with so-called "hi-pot" (high potential) tests where direct electrical current is applied to the stator bar windings. A study initiated by ConEd and Brookhaven's Tracer Technology Center to explore the cause of these leakage problems to determine if the failures originate in the manufacturing process or are created in service by phase related torque stresses. To this purpose bars that had failed the hi-pot test were investigated first with the insulation in place and then stripped to the bare copper. The bars were pressurized with gases containing perfluorocarbon tracers and the magnitude and location of the leaks was detected by using tracers technology principles and instruments such as the "double source" method and the Dual Trap Analyzer. In the second part of the project the windings within a generator were tested in-situ for leaks during an outage using tracer principles. Recommendations are given suggesting the shut down of stator bar cooling water before hydrogen bleeding during outages and a revision of the current vent flow rate. The new standard should establish a reasonable leak rate for the stator bar windings proper and exclude leakage of pump seals and connections. Testing during the maintenance cycle in generators should include routine tracer leak detection following the hi-pot test.

6637 (BNL-NUREG–46331) **Detecting and mitigating aging in component cooling water systems.** Lofaro, R.J. Brookhaven National Lab., Upton, NY (United States). [1991]. 13p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC02-76CH00016. (CONF-911079–17: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). Order Number DE92004989. Source: OSTI; NTIS; INIS; GPO Dep.

The time-dependent effects of aging on component cooling water (CCW) systems in nuclear power plants has been studied and documented as part of a research program sponsored by the US Nuclear Regulatory Commission. It was found that age related degradation leads to failures in the CCW system which can result in an increase in system unavailability, if not properly detected and mitigated. To identify effective methods of managing this degradation, information on inspection, monitoring, and maintenance practices currently available was obtained from various operating plants and reviewed. The findings were correlated with the most common aging mechanisms and failure modes and a compilation of aging detection and mitigation practices was formulated. This paper discusses the results of this work.

6638 (CONF-910808–7) **Effects of thermal aging and neutron irradiation on the mechanical properties of stainless steel weld overlay cladding.** Haggag, F.M.; Nanstad, R.K. Oak Ridge National Lab., TN (United States). [1991]. 6p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. From 5. international symposium on environmental degradation on materials in nuclear power systems - water reactors; Monterey, CA (United States); 25-29 Aug 1991. Order Number DE92004443. Source: OSTI; NTIS; INIS; GPO Dep.

Stainless steel weld overlay cladding was fabricated using the three-wire, series-arc method. Three layers of cladding were applied to a pressure vessel plate to provide adequate thickness for fabrication of test specimens. Since irradiation of the stainless steel cladding to 5×10^{19} neutrons/cm^2 (>1 MeV) was conducted at 288°C for 1605 h, tensile, Charpy V-notch (CVN), precracked Charpy V-notch (PCVN), and compact fracture toughness specimens were thermally aged at 288°C for 1605 h. Additional specimens are being aged to 20,000 and 50,000 h. Thermal aging of three-wire, series-arc stainless steel weld overlay cladding at 288°C for 1604 h resulted in appreciable decrease (16%) in the

CVN upper-shelf energy, but the effect on the 41-J transition temperature shift was very small (3°C). The combined effect, following neutron irradiation at 288°C to a fluence of 5 x 10^{19} neutrons/cm^2 (>MeV), was a 22% reduction in the CVN upper-shelf energy and a 29°C shift at the 41-J level. The effect of thermal aging on tensile properties was very small or negligible. However, the combined effect after neutron irradiation was an increase in the yield strength (6 to 34% at test temperatures from 288 to −125°C) and no apparent change in ultimate strength and total elongation. Also, neutron irradiation reduced the initiation fracture toughness (J_{Ic}) much more than did thermal aging. However, irradiation slightly decreased the tearing modulus, but no reduction was caused by thermal aging alone. The effects of long-term thermal exposure times (20,000 and 50,000 h) will be investigated when the specimen become available.

6639 (CONF-9110236–2) **NRC data base for power reactor surveillance programs and for irradiation experiments results.** Kam, F.B.K.; Stallmann, F.W. Oak Ridge National Lab., TN (United States). [1991]. 6p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. From Working group 3 Joint Coordinating Committee on Nuclear Reactor Safety (JCCNRS) meeting; Oak Ridge, TN (United States); 16-18 Oct 1991. Order Number DE92001687. Source: OSTI; NTIS; INIS; GPO Dep.

The radiation damage of pressure vessel materials in nuclear reactors depends on many different factors, primarily fluence, fluence spectrum, fluence rate, irradiation temperature, and chemistry. These factors and, possibly, others such as heat treatment and type of flux used in weldments must be considered to reliably predict the pressure vessel embrittlement and to assure the safe operation of the reactor. Based on embrittlement predictions, decisions must be made concerning operating parameters, low-leakage fuel management, possible life extension, and the need for annealing of the pressure vessel. Large numbers of data obtained from surveillance capsules and test reactor experiments are needed, comprising many different materials and different irradiation conditions, to develop generally applicable damage prediction models that can be used for industry standards and regulatory guides. The US Nuclear Regulatory Agency has, therefore, sponsored a project to construct an Embrittlement Data Base (EDB) for a comprehensive collection of data concerning changes in material properties of pressure vessel steels due to neutron irradiation. A first version containing data from surveillance capsules of commercial power reactors, the Power Reactor Embrittlement Data Base (PR-EDB) Version 1, has been completed and is available to authorized users from the Radiation Shielding Information Center at the Oak Ridge National Laboratory. This document provides a discussion of the features of the current database. 1 fig.

6640 (DOE/ER/12822–T1) **Avoiding water hammer/fluid transients in nuclear piping systems by controlled filling: Final report.** Massachusetts Inst. of Tech., Cambridge, MA (United States). Dept. of Mechanical Engineering. [1991]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract FG07-88ER12822. Order Number DE92004100. Source: OSTI; NTIS; INIS; GPO Dep.

A variety of geometries and operating procedures that lead to steam bubble collapse induced water hammers have been explored experimentally. Construction guidelines that will eliminate the problem at the design stage have been proposed and methods for predicting the pressure signatures proposed.

6641 (KAERI/RR–960/90) **The thermal-hydraulic characteristics of the nuclear reactor core during accident -an investigation on thermal mixing with direct vessel injection(II)-.** Cha, Jong Hee (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Chung, Moon Ki; Won, Soon Yeon; Jun, Hyung Gil. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1991. 134p. (In Korean). Order Number DE92615089. Source: OSTI; NTIS (US Sales Only); INIS.

It is investigated thermal and fluid mixing phenomena in situations relevant to pressurized thermal shock in the downcomer of a PWR during a cooldown transient caused by direct vessel injection(DVI). The test model was designed to simulate the typical values of prototype Combustion Engineering System 80+ by approximately factors of five. The test facility is consisted with water storage tanks, heating systems, pumps, and flowmeters needed to establish the required initial conditions and to run tests of sufficient duration to achieve steady fluid temperature through out the test vessel. Test measurements include flow rates, temperatures and pressures at the boundaries of the 1/5-scale model facility to characterize the test conditions, plus over 10 local measurements of temperature within the downcomer. Test data are recorded from all instruments simultaneously on a computer-based data acquisition system for the duration of each test. The tests were carried out to simulate two postulated accident conditions. The one was small-break loss-of-coolant accident(SBLOCA), and the other was steam line break(SLB). The results were compared with predicted values calculated with REMIX-code and COMMIX-code. The compared results could corroborate the trend of thermal and fluid mixing during cooldown transient with the result of visualization tests. Analysis of test results and predicted values may lead to the following conclusion. The fluid and thermal mixing pattern may be devided into three different regions, which are the flume flow region, the mixing developing region and fully mixed region. (Author).

6642 (KAERI/RR–971/90) **A study on the removal of dissolved oxygen from the secondary water in nuclear power plants.** Kim, Yong Eak (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Sung, Ki Woung; Bae, Jae Heum. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Feb 1991. 116p. (In Korean). Order Number DE92615090. Source: OSTI; NTIS (US Sales Only); INIS.

Catalyst fixed-bed method was studied for the dissolved oxygen(D.O.) removal in makeup water. Through experiments of a catalytic liquid-solid reactor and experimental data, its modelling, it is found that about 13 l Pd-catalyst based on hydrophobic polymer resin is required to reduce D.O. concentration of 10 l/min process water from 8000 ppb to below 10 ppb. Detail design of D.O. removal process employing polymer catalyst resin and hydrogen was carried out and a portable D.O. removal equipment was manufactured based on its design. This equipment was manufactured with treating capacity 10 l/min water and has shown a good performance of reducing D.O. concentration of 8 ppm in the water to below 10 ppb. As a result of investigation about the direct application of D.O. removal process to nuclear power plants, the condensate storage tank has been chosen as the most proper place for installation of D.O. removal equipment in nuclear power plants since the tank is located to directly influence water quality of reactor system and the equipment can be easily attached to the condensate tank without any major modification of existing plants. (Author).

6643 (PNL-SA–18065) **Mechanistic understanding of irradiation-induced corrosion of zirconium alloys in nuclear power plants: Stimuli, status, and outlook.** Johnson, A.B. Jr.; Ishigure, K.; Nechaev, A.F.; Reznichenko, E.A.; Cox, B.; Lemaignan, C.; Petrik, N.G. Pacific Northwest Lab., Richland, WA (United States). May 1990. 26p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-9005400–1: International Atomic Energy Agency (IAEA) conference, Alushta (USSR), 22-25 May 1990). Order Number DE92004516. Source: OSTI; NTIS; INIS; GPO Dep.

Failures in the basic materials used in nuclear power plants continue to be costly and insidious, despite increasing industry vigilance to catch failures before they degrade safety. For instance, the overall costs to the US industry from materials problems could amount to as much as $10 billion annually. Moreover, estimates indicate that the cost of a pipe failure in a nuclear plant is one hundred times greater than the cost of a similar failure in a coal-fired plant. There are important practical stimuli and much scope for further understanding of the effects of irradiation on Zr-alloys (and other materials used in nuclear installations) by careful experimentation. Moreover, these studies need to address the effect of irradiation on all components of heterogeneous systems: the metal, the oxide and the environment, and especially those processes recurring at the interphases between these components. The present paper is aimed at providing specialists with some systematic information on the subject and with important considerations on the key items for further experimentation.

6644 (PNL-SA–20093) **Snubber aging assessment: Results of NPAR Phase 2 in-plant research.** Blahnik, D.E. (Pacific Northwest Lab., Richland, WA (United States)); Werry, E.V.;

Brown, D.P. Pacific Northwest Lab., Richland, WA (United States). Oct 1991. 11p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC06-76RL01830. (CONF-911079–4: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). Order Number DE92002736. Source: OSTI; NTIS; INIS; GPO Dep.

Snubbers are safety-related devices used to restrain undesirable dynamic loads at various piping and large equipment locations in nuclear power plants (NPPs). Snubbers are designed to accommodate normal thermal movements of a plant's operating systems or equipment and to be capable of restraining the maximum off-normal dynamic loads postulated for its specific location. Snubbers are subject to the effects of aging, and the factors that degrade their safety performance need to be better understood. This paper describes the US Nuclear Regulatory Commission (NRC) Phase 2 Nuclear Plant Aging Research (NPAR) in-plant aging study conducted to enhance the understanding of snubber aging, providing a basis to mitigate its consequences. The research methodology, results, recommendations, and conclusions are described in this paper. Recommendations for monitoring the service life of snubbers is a principal result of the research and will provide input to the American Society of Mechanical Engineers (ASME) Operations and Maintenance (OM) Code, Subsection ISTD. 5 refs., 4 figs.

2203 Fuel Elements

Refer also to citation(s) 6589, 6590, 6591, 6602, 6668, 6693, 6977, 7181

6645 (INIS-mf–13025 vp.) **Plutonium fuel fabrication at BARC (Preprint no. IT-13).** Ganguly, C. (Bhabha Atomic Research Centre, Bombay (India). Radiometallurgy Div.). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. Feb 1991. 685p. (CONF-9102132–: International symposium on radiochemistry and radiation chemistry - plutonium 50, Bombay (India), 4-7 Feb 1991). In *International symposium on radiochemistry and radiation chemistry (Plutonium - 50 years) (held at Bombay during February 4-7, 1991): Preprints volume.* Order Number DE92001334. Source: OSTI; NTIS (US Sales Only); INIS.

Plutonium fuel fabrication in India was initiated nearly two decades ago when the core for the PURNIMA research reactor at BARC, consisting of SS 316 clad PuO_2 pins was prepared at Radiometallurgy Division (RMD). This was soon followed by fabrication of Al clad Al-Pu plate fuel elements and sub-assemblies, the experience of which was recently utilised for production of Al clad Al-23% Pu plate fuel subassemblies for PURNIMA III. During the last 15 years extensive research and development have been carried out on fabrication of plutonium bearing ceramic fuel pellets at RMD. The fuels developed so far include: (i) $(U,Pu)O_2$ and $(Th,PU)O_2$ containing upto 6% Pu for pressurised heavy water reactors (PHWR), (ii) mixed uranium plutonium oxide (MOX), monocarbide (MC) and mononitride (MN) containing between 20% and nearly 70% Pu for liquid metal cooled fast breeder reactors (LMFBR). A sophisticated carbide laboratory has been set up, where the fabrication of (Usub(0.3)Pusub(0.7))C fuel pellets and pins for the first core of fast breeder test reactor (FBTR) has been successfully completed. Presently, the facility is being utilised for development of MOX, MC and MN fuels for the forthcomming prototype fast breeder reactor (PFBR). Conventional powder-pellet and advanced sol-gel microsphere pelletisation (SGMP) processes have been developed for fabrication of MOX, MC and MN pellets. (author). 15 refs., 3 tabs., 12 figs.

6646 (INIS-mf–13025 vp.) **Chemical behavior of fission product iodine in irradiated oxide fuel pins for nuclear reactors (Preprint no. IT-15).** Yamawaki, M. (Tokyo Univ. (Japan). Faculty of Engineering); Konashi, Kenji. Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. Feb 1991. 685p. (CONF-9102132–: International symposium on radiochemistry and radiation chemistry - plutonium 50, Bombay (India), 4-7 Feb 1991). In *International symposium on radiochemistry and radiation chemistry (Plutonium - 50 years) (held at Bombay during February 4-7, 1991): Preprints volume.* Order Number DE92001334. Source: OSTI; NTIS (US Sales Only); INIS.

This review summarizes theoretical and experimental studies of CsI radiolysis in an operating fuel pin. From this review, it is concluded that the radiation effect is important for the understanding of chemical behavior of iodine in operating fuel pins. (author). 19 refs., 2 tabs., 4 figs.

6647 (KAERI-II/RR–22/90) **Decontamination and restoration technology development.** Oh, Won Zin (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Won, Hui Zun; Kim, Hong Pyo; Jung, Chong Hun; Moon, Jei Kwon; Park, Sang Yun; Shim, Jun Bo; Choi, Wang Kyu; Jun, Yong Bum; Yoo, Kil Seong. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Apr 1991. 421p. (In Korean). Order Number DE92614813. Source: OSTI; NTIS (US Sales Only); INIS.

This study is to develop a chemical decontamination technology applicable in a high radiation field such as spent fuel decontamination. A new decontamination formulation was developed in this study by adding ascorbic acid into the existing KAERI chemicals mainly consisting of EDTA and citric acid showed remarkable improvement in dissolution rate of nickel ferrite particles which were hard to be removed by conventional chemical decontamination reagents. The decontamination process development using the reagent was also carried out in this study. The hot loop decontamination tests using the specimens of Inconel-600 and SUS-304 contacted with the pressure boundary of primary coolant in Kori Unit 1 showed high decontamination factors which is as good as or even better than those of foreign processes such as LOMI and CAN-DECON. The decontamination test using spent fuel rod in Kori Unit 1 resulted in almost complete removal of crud from the rod surface. The material damages measured by corrosion surveilance specimen were very small and no localized corrosion were detected. The catalytic wet oxidation behaviors were also studied to decompose decontamination wastes. The Fe(II) catalyst was found to be effective. (Author).

6648 (KAERI/RR–938/90) **A study on the laser welding of aluminium for end-capping of KMRR fuel elements.** Kim, Cheol Jung (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Jung, Chin Man; Kim, Soo Sung; Kim, Jeong Moog; Kim, Min Suk; Kim, Kwang Suk; Kim, Duk Hyeon. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1991. 105p. (In Korean). Order Number DE92615092. Source: OSTI; NTIS (US Sales Only); INIS.

The selecting of proper welding process for aluminum end-capping of KMRR nuclear fuel elements is considered important in respect to the soundness of weldments and the improvement of the performance of nuclear fuels during the operation in reactor. The aluminum end-caps of KMRR nuclear fuels are welded and sealed up circumferentially, connecting end-capping and U-Si-Al fuel rod core. This study is to investigate the characteristics of the laser welded specimen and make some samples for the end-cap welding of KMRR nuclear fuels. Also, the materials principles and theories for the laser welding of aluminum were analyzed and reviewed. In order to prevent aluminum materials from the weld defects, it is required that laser power density is slightly higher than that of the threshold for the plasma generation. Especially it can be also seen that the helium gas is more effective than argon gas to decrease porosity. (Athor).

6649 (KAERI/RR–942/90) **Development of post-irradiation examination and evaluation techniques for nuclear reactor fuel.** Ro, Seong Gy (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Kim, Eun Ka; Min, Duck Kee. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Dec 1990. 242p. (In Korean). Order Number DE92615093. Source: OSTI; NTIS (US Sales Only); INIS.

Fuels discharged from the KORI-1 nuclear power plant have been subjected to hot-cell examination at the post-irradiation examination facility of the Korea Atomic Energy Research Institute. The main objectives were to increase the technical depth of the post-irradiation examination (PIE) and evaluation, and to prepare systemic data base of the irradiation behavior for pressurized water reactor fuels. The examination items include a visual inspection, a dimensional measurement, and a gamma-scanning for the fuel assembly in pool. The hot-cell examination items for the fuel rod are a visual inspection, a profilometry, an axial gamma-scanning, an eddy current testing, a X-ray radiography, a fission gas collection, and its chemical composition analysis, a metallography, a ceramography, a micro gamma-scanning, a densimetry, and a burnup measurement by the chemical analysis method. The in-core fuel behavior parameters, such as a fuel rod/stack length change, a rod internal pressure change, a fission gas release rate, a cladding corrosion, fuel rod creep and growth, and a burnup, have been determined experimentally and compared with the predicted values by means of computer codes. It is appeared that the predicted values are well agreeable with the experimental results, except that for the fuel rod growth. (Author).

6650 **Critical heat flux test apparatus.** Welsh, R.E.; Doman, M.J.; Wilson, E.C. To Dept. of Energy. 1990. Filed date 31 May 1990. USA Patent patent application 7-531,355. 14p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC11-76PN00014. Order Number DE92003661. Source: OSTI; NTIS; GPO Dep.

An apparatus for testing, in situ, highly irradiated specimens at high temperature transients is provided. A specimen, which has a thermocouple device attached thereto, is manipulated into test position in a sealed quartz heating tube by a robot. An induction coil around a heating portion of the tube is powered by a radio frequency generator to heat the specimen. Sensors are connected to monitor the temperatures of the specimen and the induction coil. A quench chamber is located below the heating portion to permit rapid cooling of the specimen which is moved into this quench chamber once it is heated to a critical temperature. A vacuum pump is connected to the apparatus to collect any released fission gases which are analyzed at a remote location.

2204 Control Systems

Refer also to citation(s) 6734, 7387

6651 (CONF-920308-3) **Development of High Flux Isotope Reactor (HFIR) subcriticality monitoring methods.** Rothrock, R.B. Oak Ridge National Lab., TN (United States). [1991]. 10p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. From Advances in reactor physics; Charleston, SC (United States); 8-11 Mar 1992. Order Number DE92001957. Source: OSTI; NTIS; INIS; GPO Dep.

Use of subcritical source multiplication measurements during refueling has been investigated as a possible replacement for out-of-reactor subcriticality measurements formerly made on fresh HFIR fuel elements at the ORNL Critical Experiment Facility. These measurements have been used in the past for preparation of estimated critical rod positions, and as a partial verification, prior to reactor startup, that the requirements for operational shutdown margin would be met. Results of subcritical count rate data collection during recent HFIR refuelings and supporting calculations are described illustrating the intended measurement method and its expected uncertainty. These results are compared to historical uses of the out-of-reactor core measurements and their accuracy requirements, and a planned in-reactor test is described which will establish the sensitivity of the method and calibrate it for future routine use during HFIR refueling. 2 refs., 1 fig., 2 tabs.

6652 (CONF-920308-6) **Monitoring nuclear reactor systems using neural networks and fuzzy logic.** Ikonomopoulos, A. (Tennessee Univ., Knoxville, TN (United States)); Tsoukalas, L.H.; Uhrig, R.E.; Mullens, J.A. Oak Ridge National Lab., TN (United States). [1991]. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Advances in reactor physics; Charleston, SC (United States); 8-11 Mar 1992. Order Number DE92003406. Source: OSTI; NTIS; INIS; GPO Dep.

A new approach is presented that demonstrates the potential of trained artificial neural networks (ANNs) as generators of membership functions for the purpose of monitoring nuclear reactor systems. ANN's provide a complex-to-simple mapping of reactor parameters in a process analogous to that of measurement. Through such "virtual measurements" the value of parameters with operational significance, e.g., control-valve-disk-position, valve-line-up or performance can be determined. In the methodology presented the output of a virtual measuring device is a set of membership functions which independently represent different states of the system. Utilizing a fuzzy logic representation offers the advantage of describing the state of the system in a condensed form, developed through linguistic descriptions and convenient for application in monitoring, diagnostics and generally control algorithms. The developed methodology is applied to the problem of measuring the disk position of the secondary flow control valve of an experimental reactor using data obtained during a start-up. The enhanced noise tolerance of the methodology is clearly demonstrated as well as a method for selecting the actual output. The results suggest that it is possible to construct virtual measuring devices through artificial neural networks mapping dynamic time series to a set of membership functions and thus enhance the capability of monitoring systems. 8 refs., 11 figs., 1 tab.

6653 (DOE/ER/12809-4) **The slightly-enriched spectral shift control reactor: Final report, September 30, 1988–September 30, 1991.** Martin, W.R. (Michigan Univ., Ann Arbor, MI (United States). Dept. of Nuclear Engineering); Lee, J.C.; Larsen, E.W.; Edlund, M.C. Michigan Univ., Ann Arbor, MI (United States). Dept. of Nuclear Engineering. Nov 1991. 75p. Sponsored by U.S. DOE Energy Research. DOE Contract FG07-88ER12809. Order Number DE92004026. Source: OSTI; NTIS; INIS; GPO Dep.

An advanced converter reactor design utilizing mechanical spectral shift control rods in a conventional pressurized water reactor configuration is under investigation. The design is based on the principle that a harder spectrum during the early part of the fuel cycle will result in large neutron captures in fertile ^{238}U, which can then be burned in situ in a softer spectrum later in the cycle. Preliminary design calculations performed during FY 89 showed that the slightly-enriched spectral shift reactor design offers the benefit of substantially increased fuel resource utilization with the proven safety characteristics of the pressurized water reactor technology retained. Optimization of the fuel design and development of fuel management strategies were carried out in FY 90, along with effort to develop and validate neutronic methodology for tight-lattice configurations with hard spectra. During FY 91, the final year of the grant, the final Slightly-Enriched Spectral Shift Reactor (SESSR) design was determined, and reference design analyses were performed for the assemblies as well as the global core configuration, both at the beginning of cycle (BOC) and with depletion. The final SESSR design results in approximately a 20% increase in the utilization of uranium resources, based on equilibrium fuel cycle analyses. Acceptable pin power peaking is obtained with the final core design, with assembly peaking factors equal to less than 1.04 for spectral shift control rods both inserted and withdrawn, and global peaking factors at BOC predicted to be 1.4. In addition, a negative Moderation Temperature Coefficient (MTC) is maintained for BOC, which is difficult to achieve with conventional advanced converter designs based on a closed fuel cycle. The SESSR design avoids the need for burnable poison absorber, although they could be added if desired to increase the cycle length while maintaining a negative MTC.

6654 (DOE/ER/12889-11) **Intelligent distributed control for nuclear power plants.** Klevans, E.H. Pennsylvania State Univ., University Park, PA (United States). 30 Sep 1991. 1p. Sponsored by U.S. DOE Energy Research. DOE Contract FG07-89ER12889. Order Number DE92003996. Source: OSTI; NTIS; GPO Dep.

Short communication. NUCLEAR POWER PLANTS/ computerized control systems; PROGRESS REPORT; COMPUTERIZED SIMULATION; DIAGNOSTIC TECHNIQUES; ARTIFICIAL INTELLIGENCE

6655 (EGG-2663) **Software reliability models for critical applications.** Pham, H.; Pham, M. EG and G Idaho, Inc., Idaho Falls, ID (United States). Dec 1991. 98p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC07-76ID01570. Order Number DE92004797. Source: OSTI; NTIS; GPO Dep.

This report presents the results of the first phase of the ongoing EG&G Idaho, Inc. Software Reliability Research Program. The program is studying the existing software reliability models and proposes a state-of-the-art software reliability model that is relevant to the nuclear reactor control environment. This report consists of three parts: (1) summaries of the literature review of existing software reliability and fault tolerant software reliability models and their related issues, (2) proposed technique for software reliability enhancement, and (3) general discussion and future research. The development of this proposed state-of-the-art software reliability model will be performed in the second place. 407 refs., 4 figs., 2 tabs.

6656 (GA-A-20717) **MHTGR steam generator on-line heat balance, instrumentation and function.** Klapka, R.E. (General Atomics, San Diego, CA (United States)); Howard, W.W.; Etzel, K.T.; Basol, M.; Karim, N.U. General Atomics, San Diego, CA (United States). Sep 1991. 2p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC03-89SF17885. (CONF-911104–2: Nuclear energy forum: a new strategy to build on, San Francisco, CA (United States), 10-14 Nov 1991). Order Number DE92002311. Source: OSTI; NTIS; INIS; GPO Dep.

Instrumentation is used to measure the Modular High Temperature Gas-Cooled Reactor (MHTGR) steam generator dissimilar metal weld temperature during start-up testing. Additional instrumentation is used to determine an on-line heat balance which is maintained during the 40 year module life. In the process of calibrating the on-line heat balance, the helium flow is adjusted to yield the optimum boiling level in the steam generator relative to the dissimilar metal weld. After calibration is complete the weld temperature measurement is non longer required. The reduced boiling level range results in less restrictive steam generator design constraints.

6657 (KAERI/RR–948/90) **A study on the human factors of nuclear power plants man-machine interface.** Shin, Hyun Kook (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Lee, Jeong Woon; Lee, Yong Hee; Oh, In Suk; Park, Geun Ok. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1991. 240p. (In Korean). Order Number DE92615094. Source: OSTI; NTIS (US Sales Only); INIS.

Approaches of the MMIS design were analysed in this project. Both systems approach and experimental approach were studied. In addition, guidelines for the design of MMI are discussed. The methodology of experimental approach studied in this project can be useful for establishing experimental criteria on MMI design items. The framework of a computer code was developed by utilizing function-based task analysis and procedure information requirements. This can be further developed as a tool useful for the verification and validation of MMI designs. A test facility was designed in compliance with the purpose of experimental approach by considering specific conditions and factors inherent in nuclear power plants. Test facility can be used for conducting experiments which provide detailed human performance and characteristics data at the low level of systems approach. An experimental study was performed to obtain a range of illumination levels suitable for the operation in VDU-based control rooms. Existing design guidelines were tested by this experimental study. A conceptual design of MMIS was developed in accordance with the established MMIS design approach and was evaluated through the comparison to other advanced control room designs. (Author).

6658 (KAERI/RR–984/90) **Optimization of dynamic terms in core overtemperature delta-T trip function.** Park, Jin Ho (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Yoo, Hyung Keun; Um, Kil Sup; Kim, Hee Cheol; Lee, Jong Chul. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Mar 1991. 72p. Order Number DE92615095. Source: OSTI; NTIS (US Sales Only); INIS.

The characteristics of the core overtemperature Delta-T (OT Delta-T) dynamic terms are investigated for various time constants. In addition, the effects of the dynamic terms on the OT Delta-T trip setpoint in case of the uncontrolled RCCA bank withdrawal at power transient are studied by using the NLOOP and the PUMA code. Based on the above study, the procedure in determining the optimal dynamic term is suggested and the time constants of the OT Delta-T dynamic terms are optimized for the KORI 3 and 4 transition core. It reveals that the most improtant one in the OT Delta-T dynamic terms affecting the minimum DNBR thorugh the system transient is the vessel average temperature lead-lag term, and the optimized time constants are 21 seconds for lead and 4 seconds for lag. By this optimization, the core operation region is expected to be improved without changing the core safety limits. (Author).

6659 (PNL-SA–19551) **Towards the development of multilevel-multiagent diagnostic aids.** Stratton, R.C.; Jarrell, D.B. Pacific Northwest Lab., Richland, WA (United States). Oct 1991. 25p. Sponsored by U.S. DOE Nuclear Energy; Nuclear Regulatory Commission. DOE Contract AC06-76RL01830. (CONF-9110272–1: 2. international workshop on principles of diagnosis, Milano (Italy), 14-16 Oct 1991). Order Number DE92002701. Source: OSTI; NTIS; INIS; GPO Dep.

Presented here is our methodology for developing automated aids for diagnosing faults in complex systems. We have designed these aids as multilevel-multiagent diagnostic aids based on principles that should be generally applicable to any complex system. In this methodology, "multilevel" refers to information models described at successful levels of abstraction that are tied together in such a way that reasoning is directed to the appropriate level as determined by the problem solving requirements. The concept of "multiagent" refers to the method of information processing within the multilevel model network; each model in the network is an independent information processor, i.e., an intelligent agent. 19 refs., 15 figs., 9 tabs.

2205 Environmental Aspects

Refer also to citation(s) 6377, 6455, 6672, 6680, 6688, 6726, 6749, 7787

6660 (BNWL-CC–505) **Results of research concerning phosphorus-32 in reactor effluent.** Silker, W.B. Battelle-Northwest, Richland, WA (United States). Pacific Northwest Lab. Nov 1965. 14p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE92003730. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Several processes for reducing the concentration of radioisotopes in reactor effluent water have been developed and evaluated. Application of the high alum process for the treatment of reactor cooling water has resulted in a reduction in p^{32} concentration by a factor of 2.3 from pre-1961 levels. An additional factor of 2 could be obtained by subtituting nitrate salts for the sulfates currently employed in the process. Addition of sodium silicate to the cooling water demonstrated to provide a factor of three reduction in the effluent concentration of p^{32}. Passage of reactor effluent water through a bed of aluminum turnings removed half of the p^{32} by adsorption on the aluminum corrosion film. The benefits from these treatments are cumulative; thus, by adoption of both sodium silicate addition and substitution of nitrate salts in the water treatment process the p^{32} concentration could be reduced to about 10% of the 1960 levels. Prior to 1961, it was shown that two-thirds of the p^{32} in-reactor effluent water resulted from activation of inert phosphorus, but that currently, 80% results from n,p reaction on S^{32}. Phosphate ions were found to engage in complex reactions with the film on in-reactor surfaces and are retained for extended lengths of time, while sulfate ions are rapidly released from the film surfaces. Roughly two-thirds of the p^{32} was produced on the surface of aluminum fuel elements, and one-third on the aluminum tube wall. Zirconium components did not provide significant sites for the retention and neutron activation of p^{32} parent isotopes. The chemical form of radiophosphorus in reactor effluent water was determined, both during normal operation and during reactor shutdown. 29 refs., 6 tabs.

6661 (BNWL-SA–668) **Fission product aerosol behavior in the PRTR fuel rod failure of September 29, 1965.** Perkins, R.W.; Thomas, C.W.; Silker, W.B. Pacific Northwest Lab., Richland, WA (United States). 22 Nov 1965. 54p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE92003510. Source: OSTI; NTIS (US Sales Only); GPO Dep.

On September 29, 1965, at 0150 a purposely defected partially molten fuel rod in the rupture loop test facility of the PRTR reactor failed in an unexpected manner. The rupture which resulted in a loss of about 30% of the UO_2-PuO_2 fuel from the rod was accompanied by the formation of a hole of approximately 1/2 inch diameter in the surrounding process tube. The subsequent flashing of the highly contaminated superheated water, released a fission product aerosol to the containment vessel atmosphere. This release resulted in about half of the noble gases reaching the containment vessel atmosphere. About 1 percent of the radioiodine and a somewhat smaller fraction of the solid fission products entered the containment vessel atmosphere. A subsequent radiochemical study provided detailed information on the behavior of some 15 fission products and of plutonium in their movement, following the rod failure, through the various liquid and gaseous systems of the reactor and its containment vessel. The ratios of the fission products (other than the noble gases) which were release to the containment vessel atmosphere were not far different from those in the fuel rod showing that relatively little fractionation occurred in the processes of dis- solution and aerosol formation. The observed deposition per unit area on metal surfaces was much higher than on painted surfaces. Much of the behavior of the radionuclides in this system was similar to what might be expected in the melt-down of any water cooled reactor and the information gained from the study should be applicable to the design of safeguards for such events.

6662 (DOE-HMIP-RR-91.035) **Discharges from nuclear power stations.** Department of the Environment, London (United Kingdom). Her Majesty's Inspectorate of Pollution; Atkins (W.S.) Engineering Sciences Ltd., Warrington (United Kingdom). Feb 1991. 255p. Contract PECD-7/9/465. Order Number DE92614966. Source: OSTI; NTIS (US Sales Only); INIS.

HM Inspectorate of Pollution commissioned, with authorising responsibilities in England and Wales, a study into the discharges of radioactive effluents from Nuclear Power Stations. The study considered arisings from nuclear power stations in Europe and the USA and the technologies to treat and control the radioactive discharges. This report contains details of the technologies used at many nuclear power stations to treat and control radioactive discharges and gives, where information was available, details of discharges and authorised discharge limits. (author).

6663 (DUH–10548) **Admixture of pile effluent with river.** Hanford Works, Richland, WA (United States). 26 Jan 1945. 2p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE92002849. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Short communication. HANFORD PRODUCTION REACTORS/radioactive effluents; COLUMBIA RIVER/environmental impacts; TEMPERATURE GRADIENTS; LAYERS; COOLING PONDS; NOZZLES; JETS

6664 (HW–78458) **Crud and film program status report.** FitzPatrick, V.F. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 30 Jul 1963. 10p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE92002847. Source: OSTI; NTIS (US Sales Only); GPO Dep.

During routine operation of pressurized water reactors, the piping walls become radioactively contaminated. The contamination results from the buildup of radionuclides in the piping films and the deposition of particulate solids (crud) that have become activated by recirculating through a nuclear flux. Several serious problems, both mechanical and economical, arise from the buildup of crud and background radioactivity in a reactor system. To minimize such buildup it is necessary to understand the mechanisms by which they occur and the relative importance of operating variables (i.e., coolant quality, temperature, flux, velocity and etc.). The purpose of this report is to review the problem areas involved, to summarize the progress to date, and present a program to accomplish the remainder of the goals. 8 refs.

6665 (HW-SA–3547) **Preliminary rough draft of contribution to book manuscript: Chapter 6, Contamination and film formation.** Richman, R.B. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 25 May 1964. 9p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE92002841. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document is a preliminary rough draft and it provides a discussion of corrosion, film buildup, and contamination in reactor cooling systems. The important radionuclides and their means of production in single-pass cooled reactors are discussed. The characteristics of films formed are also discussed. (FI)

6666 (NUREG/CR–5345) **Fission product release and fuel behavior of irradiated light water reactor fuel under severe accident conditions: The ACRR ST-1 Experiment.** Allen, M.D. (Sandia National Labs., Albuquerque, NM (United States)); Stockman, H.W.; Reil, K.O.; Fisk, J.W. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Systems Research; Sandia National Labs., Albuquerque, NM (United States). Nov 1991. 298p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC04-76DP00789. (SAND–89-0308). Source: OSTI; NTIS; INIS; GPO.

The annular Core Research Reactor (ACRR) Source Term (ST) Experiment program was designed to obtain time-resolved data on the release of fission products from irradiated fuels under well-controlled light water reactor severe accident conditions. The ST-1 Experiment was the first of two experiments designed to investigate fission product release. ST-1 was conducted in a highly reducing environment at a system pressure of approximately 0.19 MPa, and at maximum fuel temperatures of about 2490 K. The data will be used for the development and validation of mechanistic fission product release computer codes such as VICTORIA.

6667 (NUREG/CR–5808) **Calculation of absorbed doses to water pools in severe accident sequences.** Weber, C.F. (Oak Ridge National Lab., TN (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Div. of Systems Research; Oak Ridge National Lab., TN (United States). Dec 1991. 40p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. (ORNL/TM–11970). Source: OSTI; NTIS; INIS; GPO.

A methodology is presented for calculating the radiation dose to a water pool from the decay of uniformly distributed nuclides in that pool. Motivated by the need to accurately model radiolysis reactions of iodine, direct application is made to fission product sources dissolved or suspended in containment sumps or pools during a severe nuclear reactor accident. Two methods of calculating gamma absorption are discussed - one based on point-kernal integration and the other based on Monte Carlo techniques. Using least-squares minimization, the computed results are used to obtain a correlation that relates absorbed dose to source energy and surface-to-volume ratio of the pool. This correlation is applied to most relevant fission product nuclides and used to actually calculate transient sump dose rate in a pressurized-water reactor (PWR) severe accident sequence.

2206 Research, Test, Training, Production, Irradiation, Materials Testing Reactors

Refer also to citation(s) 6338, 6339, 6340, 6455, 6651, 6652, 6660, 6661, 6663, 6665, 6666, 6705, 6710, 6711, 6719, 6720, 6721, 6760, 6800, 7735

6668 (ANL/CP–74817) **Transition from HEU to LEU fuel in Romania's 14-MW TRIGA reactor.** Bretscher, M.M.; Snelgrove, J.L. Argonne National Lab., IL (United States). [1991]. 27p. Sponsored by U.S. DOE Assistant Secretary for International Affairs and Energy Emergencies. DOE Contract W-31109-ENG-38. (CONF-9111149–2: 14. international meeting on reduced enrichment for research and test reactors, Jakarta (Indonesia), 4-7 Nov 1991). Order Number DE92004138. Source: OSTI; NTIS; INIS; GPO Dep.

The 14-MW TRIGA steady state reactor (SSR) located in Pitesti, Romania, first went critical in the fall of 1979. Initially, the core configuration for full power operation used 29 fuel clusters each containing a 5 × 5 square array of HEU (10 wt%) – ZrH – Er (2.8 wt%) fuel-moderator rods (1.295 cm o.d.) clad in Incology. With a total inventory of 35 HEU fuel clusters, burnup considerations required a gradual expansion of the core from 29 to 32 and finally to 35 clusters before the reactor was shut down because of insufficient excess reactivity. At this time each of the original 29 fuel clusters had an overage ^{235}U burnup in the range from 50 to 62%. Because of the US policy regarding the export of highly enriched uranium, fresh HEU TRIGA replacement fuel is not available. After a number of safety-related measurements, the SSR is expected to resume full power operation in the near future using a mixed core containing five LEU TRIGA clusters of the same geometry as the original fuel but with fuel-moderator rods containing 45 wt% U

(19.7% ^{235}U enrichment) and 1.1 wt% Er. Rods for 14 additional LEU fuel clusters will be fabricated by General Atomics. In support of the SSR mixed core operation numerous neutronic calculations have been performed. This paper presents some of the results of those calculations.

6669 (ANL/CP-74818) **Status report on conversion of the Georgia Tech Research Reactor to low enrichment fuel.** Karam, R.A. (Georgia Inst. of Tech., Atlanta, GA (United States)); Matos, J.E.; Mo, S.C.; Woodruff, W.L. Argonne National Lab., IL (United States). [1991]. 10p. Sponsored by U.S. DOE Assistant Secretary for International Affairs and Energy Emergencies. DOE Contract W-31109-ENG-38. (CONF-9111149-3: 14. international meeting on reduced enrichment for research and test reactors, Jakarta (Indonesia), 4-7 Nov 1991). Order Number DE92004137. Source: OSTI; NTIS; INIS; GPO Dep.

The 5 MW Georgia Tech Research Reactor (GTRR) is a heterogeneous, heavy water moderated and cooled reactor, fueled with highly-enriched uranium aluminum alloy fuel plates. The GTRR is required to convert to low enrichment (LEU) fuel in accordance with USNRC policy. The US Department of Energy is funding a program to compare reactor performance with high and low enrichment fuels. The goals of the program are: (1) to amend the SAR and the Technical Specifications of the GTRR so that LEU U_3Si_2-Al dispersion fuel plates can replace the current HEU U-Al alloy fuel, and (2) to optimize the LEU core such that maximum value neutron beams can be extracted for possible neutron capture therapy application. This paper presents a status report on the LEU conversion effort.

6670 (ANL/CP-74819) **The RERTR Program: A status report.** Travelli, A. Argonne National Lab., IL (United States). [1991]. 12p. Sponsored by U.S. DOE Assistant Secretary for International Affairs and Energy Emergencies. DOE Contract W-31109-ENG-38. (CONF-9111149-4: 14. international meeting on reduced enrichment for research and test reactors, Jakarta (Indonesia), 4-7 Nov 1991). Order Number DE92004136. Source: OSTI; NTIS; INIS; GPO Dep.

The progress of the Reduced Enrichment Research and Test Reactor (RERTR) Program is described. The major events, findings, and activities of 1991 are reviewed after a brief summary of the results which the RERTR Program had achieved by the end of 1990 in collaboration with its many international partners.

6671 (BNWL-CC-455) **N-reactor stack integrity.** Morgan, W.C. Pacific Northwest Lab., Richland, WA (United States). Jan 1966. 30p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE92002848. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The N-Reactor moderator consists of a horizontal stack of graphite bars interlocked by "Lincoln-Log" type keys. In addition to the fueled process channels, secondary coolant channels are arranged in vertical planes, passing side-to-side through the filler layers. The vertical planes of cooling tubes produce a periodic sinusoidal variation in temperature along the length of the tube blocks. The purpose of this preliminary report is to survey phenomena which could affect N-Reactor stack integrity and to estimate the dimensional changes and possible magnitude of the effects for two operating cases. Uncertainties in the data preclude precise predictions of the timing of the events at present; however, the relative magnitudes and timing of events for the two cases should be quite accurate. The precision of the predictions are of little consequence at the present time since significant changes in operating conditions are contemplated and are expected to go into effect within the next year. Several experimental programs are in progress to improve some of the estimates used in this analysis, this report can be up-dated as necessary when data become available from these programs and when interest is shown in other operating conditions. 24 refs., 12 figs., 5 tabs.

6672 (BNWL-CC-1055) **Water treatment variables – nitrate system.** Silker, W.B. Battelle Pacific Northwest Lab., Richland, WA (United States). Feb 1967. 17p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE92003731. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The radioisotopes present in Hanford reactor effluent water originate from two primary sources; activated impurities that enter the reactor through the cooling water supply, and corrosion products from in-reactor components. The coolant impurities are derived primarily from the raw Columbia River water, however, sulfates are added in the water treatment process and sodium dichromate is introduced as a corrosion inhibitor. The inert river water impurities are present in a variety of chemical and physical forms, ranging from ionic to particulate; both colloidal and larger in size. Chemical treatment of the raw water removes these materials with varying degrees of success depending on the conditions of treatment and the form in which the impurity exists. It is not within the scope of this presentation to detail the many complex parameters involved in the water treatment process, however, a brief summary of those aspects that are germane to this study are presented. The basis for treatment of the cooling water is to remove colloids, suspensoids and ionic constituents from the raw water prior to its introduction into the reactor. This study summarizes variables within the water treatment process.

6673 (CONF-920308-7) **Calculation of critical experiment parameters for the High Flux Isotope Reactor.** Primm, R.T. III. Oak Ridge National Lab., TN (United States). [1991]. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Advances in reactor physics; Charleston, SC (United States); 8-11 Mar 1992. Order Number DE92004232. Source: OSTI; NTIS; INIS; GPO Dep.

Six critical experiments were performed shortly before the initial ascension to power of the High Flux Isotope Reactor (HFIR). Critical configurations were determined at various control rod positions by varying the soluble boron content in the light water coolant. Calculated k-effective was 2% high at beginning-of-life (BOL) typical conditions, but was 1.0 at end-of-life (EOL) typical conditions. Axially averaged power distributions for a given radial location were frequently within experimental error. At specific r,z locations with the core, the calculated power densities were significantly different from the experimentally derived values. A reassessment of the foil activation data seems desirable.

6674 (DOE/DP-0094P) **Operational Readiness Review: K-Reactor restart, Savannah River Site.** Department of Energy, Washington, DC (United States). Assistant Secretary for Defense Programs. Nov 1991. 123p. Sponsored by U.S. DOE Defense Programs. Order Number DE92004779. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The K-Reactor Operational Readiness Review (ORR) is one of several activities to be completed prior to restart of the K-Reactor. The Secretary of Energy will rely in part on the results of this ORR in deciding whether the restart criteria set for the reactor have been met. The K-Reactor has been shutdown for over 3 years. Since shutdown, the Department of Energy (DOE) has required that improvements be made in the design of reactor features, that plant safety analyses be revised, and that upgrades by made in various operational and administrative areas prior to reactor startup. The conduct of this ORR was required as an independent check on the adequacy of the improvements. The review was conducted in three phases from May 13, 1991, through October 18, 1991. The ORR was conducted in four major areas, namely, operations, maintenance and surveillance, engineering and technical support, and organization and management. In addition, the ORR team assessed by sampling the adequacy of selected chapters of the Safety Evaluation Report, the adequacy of the closure process for issues in the Reactor Operations Management Plan, and compliance with DOE Orders. The ORR team review has concluded that K-Reactor can be restarted and safely operated after verified correction of the findings that are described in the report. Also, continued operation of the reactor requires timely correction and verification of the observations listed in the report.

6675 (ECN-C-91-006) **Benchmark calculations for MTR-type reactors: HEU benchmark.** Liu Guisheng (China Nuclear Information Centre, Beijing, BJ (China)); Slobben, J.; Oppe, J. Netherlands Energy Research Foundation, Petten (Netherlands). Feb 1991. 50p. Contract no. JRCP: B004422;Contract no. ECN: 0368. Order Number DE92613836. Source: OSTI; NTIS (US Sales Only); INIS.

In the framework of validation of the new ECN system of computer codes and data libraries for the calculation of neutron physics in nuclear reactor systems, a series of benchmark calculations is being performed. One of these benchmarks is the Highly Enriched Uranium bench-mark for an MTR-type of reactor; this report describes the calculational method for and the results from this benchmark study. Comparison of these results with those calculated by other organizations show a satisfactory agreement. (author). 6 refs.; 13 figs.; 20 tabs.

6676 (ECN-C–91-040) **Neutron metrology in the HFR: PSF vessel surveillance experiment SURP-02 (RX189-02) : (monitor sets series FDSURP21).** Hoving, A.H.; Voorbraak, W.P. Netherlands Energy Research Foundation, Petten (Netherlands). Mar 1991. 47p. Project nr. 0699.01;GCOP order nr. 10635. Order Number DE92613837. Source: OSTI; NTIS (US Sales Only); INIS.

In this report the results are presented for the thermal and fast neutron measurements with the first series of activation monitors loaded in surveillance experiment RX189-02 (SURP-02). (author). 17 refs.; 6 figs.; 11 tabs.

6677 (HAN–29905) **[Power levels of Hanford piles].** Peterson, A.V. (USAEC, Washington, DC (United States)). USAEC, Washington, DC (United States); Hanford Works, Richland, WA (United States). 9 Jan 1950. 2p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE92006560. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Short communication. HANFORD PRODUCTION REACTORS/reactor operation; POWER DISTRIBUTION; TEMPERATURE EFFECTS

6678 (HW–7-3689) **P Department: 100-B Area shutdown progress report, period ending March 24, 1946.** Gross, C.N. Hanford Works, Richland, WA (United States). 26 Mar 1946. 3p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE92004546. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report summarizes shutdown issues for the 100-B Area during the period ending March 24, 1946. (JL)

6679 (HW–7-3789) **P Department: 100-B Area shutdown progress report, interim March 25–April 3, 1946.** Gross, C.N. Hanford Works, Richland, WA (United States). 4 Apr 1946. 3p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE92004547. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This report discusses aspects of the 100-B Area shutdown for March 25th through April 3rd, 1946. Separation of high and normal concentration slugs is also included in the summary. (JL)

6680 (HW–30852) **Annual report for 1953 on radiation surveys of Reactor Section buildings outside exclusion areas.** Jerman, P.C. Hanford Works, Richland, WA (United States). 12 Feb 1954. 2p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE92003044. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Periodic surveys were made of all Reactor Section buildings outside of the Exclusion Areas and Radiation Zones to detect the presence of contamination. These surveys are an indication of the efficiency of the contamination control measures practiced in the respective plant areas. In general and only very low level contamination was found.

6681 (HW–51970) **K reactor's hydraulic demand.** Hess, K.W. Hanford Works, Richland, WA (United States). 16 Aug 1957. 5p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE92002874. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Short communication. HANFORD PRODUCTION REACTORS/hydraulics; HYDRAULICS; FUEL ELEMENTS; REACTOR COOLING SYSTEMS; CORROSION; REACTOR OPERATION; HEAT TRANSFER

6682 (HW–56230-RD) **Operational problems of the original Hanford production reactor.** Hanford Works, Richland, WA (United States). 10 Jul 1958. 19p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE92002875. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Operation of the Hanford production reactors has pioneered the technology of the light-water-cooled, graphite-moderated nuclear reactor. Fourteen years of operation have provided ample opportunity to determine the advantages–and the disadvantages–of this design. This article presents a brief description of the three original Hanford 100 B, D, and F production reactors and the associated water plants plus core operational problems which may be declassified at this time. 7 figs., 1 tab.

6683 (HW–58265-RD) **Water capacity without changes other than re-orificing and charging I & E slugs.** Conley, W. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 16 Dec 1957. 3p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE92002884. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Short communication. HANFORD PRODUCTION REACTORS/reactor cooling systems; REACTOR COOLING SYSTEMS/capacity; PUMPS/capacity; FEEDWATER; CAPACITY; PUMPS; FILTERS; MAINTENANCE

6684 (HW–60157) **Examination of M-388 rupture from IP-80-A (RM-224).** Gruber, W.J. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 16 Jun 1959. 10p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE92002886. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A solid, natural uranium, eight inch, HAPO fuel element failed in tube 4074 KE on 1-3-58 after an exposure of 465 MWD/T. The rupture, HAPO failure #976, which was part of production test IP-80-A, was classified as a "side hot spot" failure. After discharge, the slug was transferred to the Radiometallurgy Laboratory to determine the cause of failure and the effect of abnormally high operating temperatures on the M-388 jacket. This document provides a discussion of this failure.

6685 (HW–62585) **Examination of M-388 failure from 3665 KW (RM-305).** McMahan, M.E. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 26 Oct 1959. 3p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE92002893. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Short communication. HANFORD PRODUCTION REACTORS/fuel elements; FUEL ELEMENTS/failures; FUEL ELEMENTS/post-irradiation examination; HAPO; FAILURES; METALLURGY; WELDED JOINTS

6686 (HW–66468) **Reactor process channel water leak history, FY 1959 and 1960.** Young, J.R. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 17 Aug 1960. 11p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE92002888. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A general reduction in the frequency of leaks has occurred during the last two years – the total dropping from 163 in FY 1959 to 120 in FY 1960. This can be attributed to continued emphasis on eliminating leaks due to all causes. However, it should be noted that the frequency of three types of leaks, the thin top, the rupture, and the transverse crack, has increased. Future emphasis must be placed particularly on eliminating these leaks, in addition to continuing efforts to reduce the other types. This document discusses leak classification and causes. 3 tabs.

6687 (HW–68718-Del.) **Irradiation Processing Department monthly report for February 1961.** Hanford Works, Richland, WA (United States). 15 Mar 1961. 81p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-87RL10930. (HAN–78124-Del.). Order Number DE92001667. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document details activities of the Irradiation Processing Department during the month of February 1961. (FI)

6688 (HW-SA–2016) **Aerosol research at Hanford and engineering applications to production reactors.** Linderoth, C.E.; Heacock, H.W.; Schwendiman, L.C. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 24 Oct 1960. 24p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830 ;AC06-87RL10930. (CONF-601201–1:

Aerosol problems of nuclear reactors: chemical engineering aspects, Harwell (United Kingdom), 7-8 Dec 1960). Order Number DE92003509. Source: OSTI; NTIS (US Sales Only); GPO Dep.

When the construction of the confinement facilities for Hanford production reactors is completed, the potential for contaminating the environment with accidentally released fission products will be greatly reduced. This was demonstrated already when rupture debris burned in the rear face area of one of the reactors in which the fog spray was installed and ready for service. The fog spray effectively prevented the spread of contamination to the ventilation equipment downstream of the rear face enclosure. Also, the commercially- available absolute filters and charcoal beds will significantly decontaminate the exhaust air, stream of all fission products except the noble gases. Laboratory studies indicate that the filter system should remove at least 50 percent of all fission product halogen vapors and over 90 percent of the particulate matter released from a nuclear incident. In addition, the charcoal beds should provide an additional 90 to 95 percent decontamination of the halogens that manage to pass through the filter. It is not expected that any of the noble gases released will be removed by this system. Laboratory studies, in general, substantiate previous estimates on the release of fission products from overheated uranium fuels. The theoretical estimates are quite accurate for the volatile and semi-volatile elements but were high for the nonvolatiles. For all conditions tested in the laboratory, the measured release of strontium, barium, and zirconium was less than 0.5 percent. It was also found that most released fission products tended to deposit on any surface they contacted, a property which would cause a large fraction of fission products to be retained by the reactor and associated hardware. 11 refs., 8 figs., 6 tabs.

6689 (INFO–0335) **The effect of high-frequency ground motion on the MAPLE-X10 reactor.** Bhan, S. (Acres Consulting Services Ltd., Toronto, ON (Canada)); Dunbar, S. Atomic Energy Control Board, Ottawa, ON (Canada). Jun 1989. 62p. Order Number DE92613838. Source: OSTI; NTIS (US Sales Only); INIS.

The effect of high-frequency ground motion on structures and equipment in nuclear reactors is examined by subjecting simple linear models to selected recorded ground motions which exhibit low and high frequencies. Computed damage measures indicate that high-frequency short-duration ground motion, such as that observed in eastern North America, have a minimal effect on structures with low natural frequencies. Response spectra of high-frequency ground motion indicate that higher forces are induced in structures with high natural frequencies as compared to those induced by low-frequency ground motion. However, reported observations of earthquake damage in eastern North America suggest that high-frequency ground motion causes little of no damage to structures. This may be due to the energy absorption capability of structures. It is concluded that the response spectrum representative of ground motion observed in eastern North America may give an over-conservative measure of the response of structures with high natural frequencies, since it does not account for the typically observed short duration of high-frequency ground motion and for the energy absorption capability of structures. Detailed nonlinear analysis of specific structures with high natural frequencies should be performed to better predict the actual response. Recommendations for a nonlinear analysis of typical structures with high natural frequencies are made.

6690 (JAERI-M–91-130) **Annual progress report on the NSRR experiments, (19): January 1987 through December 1987.** Japan Atomic Energy Research Inst., Tokyo (Japan). Aug 1991. 164p. (In Japanese). Order Number DE92750960. Source: OSTI; NTIS (US Sales Only); INIS.

Fuel behavior studies in simulated reactivity initiated accident (RIA) conditions have been performed by utilizing Nuclear Safety Research Reactor (NSRR) since October 1975. This report describes the results obtained from experiments performed from January through December, 1987. A total of 38 tests was carried out during this period : those are 5 NSRR standard fuel test, 6 fuel design parameter tests (2 fuel tests with iodine, 3 tests with SUS claddings, and 1 for destructive force measurement test), 7 cooling parameter tests (3 test with flow tube and 4 bundle tests), 8 advanced type fuel tests (1 NRC tests, 5 PCI-resistant fuel tests, 2 pressurized hollow fuel tests), 1 high pressure /high temperature tests, 2 high temperature /high pressure loop tests, 3 high temperature flooding tests, 3 fuel motion observation tests, and 3 miscellaneous atmospheric pressure capsule tests (1 fuel damage test, 2 acceleration tests). The progress of computer code development is also described. (author).

6691 (JAERI-M–91-139) **Installation of JRR-2 neutron medical irradiation facility.** Arigane, Kenji (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Yamada, Tadanori; Nemoto, Denjiro; Banba, Masao; Kawarai, Kunio. Japan Atomic Energy Research Inst., Tokyo (Japan). Sep 1991. 68p. (In Japanese). Order Number DE92751016. Source: OSTI; NTIS (US Sales Only); INIS.

For Boron Neutron Capture Therapy (BNCT) on brain tumor, a medical irradiation facility has been installed in the Japan Research Reactor No.2 (JRR-2) in Japan Atomic Energy Research Institute (JAERI). This facility consists of a neutron beam tube, an irradiation room and operating room. The cross section of the neutron beam tube is 200 mm x 200 mm and the thermal neutron flux at the irradiation position is 1×10^9 n/cm^2/s with a gamma ray contamination of 1.7% at reactor thermal power of 10 MW. Single crystal bismuth filter and a polyethylene collimator were applied to optimize the neutron beam condition, and LiF tiles and Styrene-Butadiene-Rubbers (SBR) admixed with B_4C were used for suppressing the secondary gamma-rays from the construction materials of the facility. The first BNCT treatment by this facility was successfully performed on August 10th in 1990. Developments of the medical irradiation on the brain tumor and melanoma will be done by using this facility. (author).

6692 (KAERI/RR–961/90) **Fluid flow test for KMRR fuel assemblies.** Chung, Moon Ki (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Yang, Sun Kyu; Chung, Chang Hwan; Chun, See Young; Song, Chul Hha; Jun, Hyung Gil; Chung, Heung Joon; Won, Soon Yeun; Cho, Young Rho; Kim, Bok Deuk. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1991. 134p. (In Korean). Order Number DE92615115. Source: OSTI; NTIS (US Sales Only); INIS.

Hydraulic and velocity measurment tests were carried out for the KMRR fuel assembly. Two types of the KMRR fuel assembly are consist of longitudinally finned rods. Experimental data of the pressure drops and friction factors for the KMRR fuel assemlby were produced. The measurement technique for the turbulent flow structure in subchannels using the LDV was obtained. The measurement of the experimental constant of the thermal hydraulic analysis code was investigated. The results in this study are used as the basic data for the development of an analysis code. The measurement technique acquired in this study can be applied to the KMRR thermal hydraulic commissioning test and development of the domestic KMRR fuel fabrication. (Author).

6693 (KAERI/RR–964/90) **A study on KMRR utilization for fuel development.** Kang, Young Hwan (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Ryu, Woo Seog; Park, Ji Yeon; Joo, Kee Nam; Park, Jong Man; Park, Se Jin. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1991. 164p. (In Korean). Order Number DE92615116. Source: OSTI; NTIS (US Sales Only); INIS.

The most effective utilization scheme of the KMRR was studied in the field of nuclear fuel development through reviewing literatural documents on irradiation facilities and in-pile test. It is suggested that the KMRR should be used for verification tests of advanced fuels and for power ramping /cycling tests of fuel rods. In addition, the characterization tests for fuel development and the basic material research should be also performed. In-pile loops for fuel verification and/or power ramping /cycling tests are proposed to be installed in advance, and capsules are necessary for power ramping /cycling tests, fuel characterization tests and /or material tests. Instrumentation technologies for thermocouple, SPND (Self-Powered Neutron Detector) and pressure transducer, and the in-situ dimensional measuring systems have to be developed to obtain the useful and various results from irradiation tests in the KMRR. A mock-up test rod for characterizing fuel thermal response was manufactured and the related technologies as well as the design specification were set up. An equipment for microdrilling and grooving of fuel pellets and an apparatus for diffusion-bonding between zircaloy-4 and stainless steel were made. A study to verify the integrity of test rod weldments is presented using out-of pile corrosion test. (Author).

6694 (KAERI/RR–983/90) **Triga mark-II,III reactor safety re-evaluation.** Jun, Byung Jin (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Park, Sang Jun; Kim, Young Joo. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Mar 1991. 205p. (In Korean). Order Number DE92615117. Source: OSTI; NTIS (US Sales Only); INIS.

In order to revise safety analysis report of old TRIGA reactors, safety re-evaluation of these reactor was started for necessary parts. This report contains the first year results of the project scheduled for two years. The guide lines of safety re-evaluation was made by translating that of nuclear power plant from the view point of TRIGA reactor confirming the basic safety philosophy as much as possible. First of all, sections of reactor history and comparison with similar reactors are made, since the actual operation records, changes, any modification of similar reactors constructed after then, etc., are realistic and valuable data from the safety aspect of old reactor. For the effectiveness of nuclear analysis, a PC based analysis system using WIMS-D/4 and VENTURE was established, and a program for the natural convection cooling analysis of TRIGA reactor was developed. As a result of thermal-hydraulic analysis it was confirmed that the operation limit of fuel temperature set at 650 deg C without any logical reason is very close to the DNB limit. (Author).

6695 (KEK–90-25(v.1), pp. 75-86) **Status of the advanced neutron source.** Hayter, J.B. (Oak Ridge National Lab., TN (United States)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

Research reactors in the United States are becoming more and more outdated, at a time when neutron scattering is being recognized as an increasingly important technique in areas vital to the U.S. scientific and technological future. The last U.S. research reactor was constructed over 25 years ago, whereas new facilities have been built or are under construction in Japan, Russia and, especially, Western Europe, which now has a commanding lead in this important field. Concern over this situation in the early 1980's by a number of organizations, including the National Academy of Sciences, led to a recommendation that design work start urgently on an advanced U.S. neutron research facility. This recommendation is realized in the Advanced Neutron Source Project. The centerpiece of the Advanced Neutron Source will be a new research reactor of unprecedented flux ($> 7.5x10^{19}\ m^{-2}{\cdot}s^{-1}$), equipped with a wide variety of state-of-the-art spectrometers and diffractometers on hot, thermal, and cold neutron beams. Very cold and ultracold neutron beams will also be provided for specialized experiments. This paper will discuss the current status of the design and the plans for scattering instrumentation. (author).

6696 (KEK–90-25(v.1), pp. 109-118) **Pulsed neutron sources at Dubna: Their past, present and future status.** Shabalin, E.P. (Joint Inst. for Nuclear Research, Dubna (USSR)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

In 1960 the first world repetitively pulsed reactor IBR was put into operation. It was the beginning of the story how fission based pulsed neutron sources at Dubna have survived. The engineers involved have experienced many successes and failures in the course of new sources upgrading to finally come to possess the world's brightest neutron source - IBR-2. The details are being reviewed through the paper. The fission based pulsed neutron sources did not reach their final state as yet- the conceptual views of IBR prospects are being discussed with the goal to double the thermal neutron peak flux (up to $2x10^{16}$) and to enhance the cold neutron flux by 10 times (with the present one being as high that of the ISIS cold moderator). (author).

6697 (ORNL–6022) **Diversion assumptions for high-powered research reactors: ISPO C-50 Phase 1.** Binford, F.T. Oak Ridge National Lab., TN (United States). Jan 1984. 71p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC05-84OR21400. (ISPO–201). Order Number DE92002276. Source: OSTI; NTIS; GPO Dep.

This study deals with diversion assumptions for high-powered research reactors – specifically, MTR fuel; pool- or tank-type research reactors with light-water moderator; and water, beryllium, or graphite reflectors, and which have a power level of 25 MW(t) or more. The objective is to provide assistance to the IAEA in documentation of criteria and inspection observables related to undeclared plutonium production in the reactors described above, including: criteria for undeclared plutonium production, necessary design information for implementation of these criteria, verification guidelines including neutron physics and heat transfer, and safeguards measures to facilitate the detection of undeclared plutonium production at large research reactors.

6698 (SAND–91-2310C) **A fission fragment reactor concept for nuclear thermal propulsion.** Suo-Anttila, A.J.; Parma, E.J.; Pickard, P.S.; Wright, S.A.; Vernon, M.E. Sandia National Labs., Albuquerque, NM (United States). 16 Sep 1991. 12p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-920104–20: 9. symposium on space nuclear power systems, Albuquerque, NM (United States), 13-16 Jan 1992). Order Number DE92003298. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The Space Exploration Initiative requires the development of nuclear thermal and nuclear electric technologies for space propulsion for future Lunar and Mars missions. Sandia National Laboratories has proposed a new nuclear thermal propulsion concept that uses fission fragments to directly heat the propellant up to 1000 K or higher above the material temperatures. The concept offers significant advantages over traditional solid-core nuclear rocket concepts because of higher propellant exit temperatures, while at the same time providing for more reliable operation due to lower structure temperatures and lower power densities. The reactor can be operated in either a steady-state or pulsed mode. The steady-state mode provides a high thrust and relatively high specific impulse, as compared to other nuclear thermal concepts. The pulsed mode requires an auxiliary radiator for cooling, but has the possibility of achieving very high specific impulses and thrust scaleable to the radiator size. The propellant temperatures are limited only by thermal radiation and transient heat conduction back to the substrate walls. 3 refs., 15 figs.

6699 (UCRL-JC–107357) **Energy production using fission fragment rockets.** Chapline, G.; Matsuda, Y. Lawrence Livermore National Lab., CA (United States). Aug 1991. 4p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-910626–14: 6. international conference on emerging nuclear energy systems, Monterey, CA (United States), 16-21 Jun 1991). Order Number DE92002192. Source: OSTI; NTIS; INIS; GPO Dep.

Fission fragment rockets are nuclear reactors with a core consisting of thin fibers in a vacuum, and which use magnetic fields to extract the fission fragments from the reactor core. As an alternative to ordinary nuclear reactors, fission fragment rockets would have the following advantages: Approximately twice as efficient if one can directly convert the fission fragment energy into electricity; by reducing the buildup of a fission fragment inventory in the reactor one could avoid a Chernobyl type disaster; and collecting the fission fragments outside the reactor could simplify the waste disposal problem. 6 refs., 4 figs., 2 tabs.

6700 (UNI–81-01) **Loss of instrument air to N plant auxiliary buildings: Abnormal occurrence report No. 81-01: Final report.** UNC Nuclear Industries, Inc., Richland, WA (United States). 11 Jun 1982. 11p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-87RL10930. Order Number DE92001684. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document provides a discussion of the occurrence of a loss of instrument air to the N-Reactor auxiliary buildings. Causes, consequences, procedures, and recommendations are presented. (FI)

6701 (WHC-SP–0229) **N Reactor core component surveillance report for 1987.** Westinghouse Hanford Co., Richland, WA (United States). Mar 1988. 239p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-87RL10930. Order Number DE92002812. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes the results of inspections and tests performed during Calendar Year 1987 to monitor the aging of N Reactor core components. The results of each surveillance activity are compared with models of component aging or previous observations, except in parts of the graphite section where neither models nor previous observations were established or performed. In those cases where the measured data indicate unexpected aging effects, planned actions were revised. Revised plans for future surveillance on reactor core components presented in this report have been incorporated into the N Reactor Core Component 5-Year Surveillance Plan. It should be noted that the planned actions in this report do not reflect the decision to place N Reactor in a "cold standby" condition. The surveillance effort focuses on the following critical reactor core components whose performance may be degraded by aging: reactor graphite pressure tubes, the gas system, and graphite cooling tubes. The relationship of these components is illustrated. The reactor core is a cube consisting of interlocking layers of graphite surrounded by an inner metal thermal shield and an outer concrete primary shield. An inert atmosphere is maintained in the core by the gas system. The fuel is contained in Zircaloy-2 horizontal pressure tubes that penetrate the front and rear shields and are part of the reactor cooling system. Perpendicular to the pressure tubes are the horizontal control rods, which enter the reactor through both the left and right shields, and the vertical ball safety system channels, which penetrate the top and bottom shields. 50 refs., 160 figs., 18 tabs.

6702 (WHC-SP–0229-A) **N Reactor core component surveillance report for 1988.** Lamm, L.W.; Woodruff, E.M. Westinghouse Hanford Co., Richland, WA (United States). Feb 1989. 62p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-87RL10930. Order Number DE92002813. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes the results of the surveillance activities performed in calendar year 1988 to assess the effects of aging on N Reactor core components. These activities were initially planned to comply with the requirements of the N Reactor Core Component 5-Year Surveillance Plan and the "Planned Action" requirements of the 1987 surveillance Report. However, because of the decision to place N Reactor in "cold standby," the planned surveillance activities were substantially reduced. Only those activities considered absolutely necessary to be accomplished prior to placement of the reactor in "cold standby" were performed in 1988.

6703 (WHC-SP–0600-Rev.1) **Visual inspections of N Reactor horizontal control rod channels: Revision 1.** Woodruff, E.M. Westinghouse Hanford Co., Richland, WA (United States). Sep 1990. 104p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-87RL10930. Order Number DE92002811. Source: OSTI; NTIS; INIS; GPO Dep.

Safety surveillance is performed in horizontal control rod (HCR) channels to locate conditions which could slow or block rod travel. The findings guide the application of preventive measures to assure eventual rod motion impairment will not occur. Borescopes and, more recently, miniaturized closed circuit television (CCTV) cameras have been used for these examinations. Inspections and measurement results are documented in annual surveillance reports, however reported CCTV observations have been limited to highlights. The objective of this report is to catalogue the CCTV recordings in a format suitable for analysis and interpretation and to ease the access to any desired location by noting tape counter readings corresponding with each tube block in view. Searching file tapes for conditions in a specific areas in the past required counting blocks as they passed the camera to determine the distance from a feature like the edge of the reflector or a steam vent gap. This report adds the observations from recent rod channel inspections (1987 and 1988) to a comprehensive survey of graphite conditions in the moderator and reflector regions of the N Reactor core. When completed, the stand-by status of graphite components will be available for use in restart or decommissioning deliberations.

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Refer also to citation(s) 6408, 6593, 6597, 6599, 6600, 6615, 6644, 6659, 6661, 6667, 6671, 6682, 6684, 6685, 6686, 6688, 6700, 6798, 7112, 7149, 7157, 7158, 7214, 7737, 8397

6704 (ANL/CP–74781) **Analyses of corium spreading in Mark I containment geometry.** Sienicki, J.J.; Chu, C.C.; Farmer, M.T. Argonne National Lab., IL (United States). [1991]. 26p. Sponsored by Nuclear Regulatory Commission. DOE Contract W-31109-ENG-38. (CONF-911079–13: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). Order Number DE92004140. Source: OSTI; NTIS; INIS; GPO Dep.

An assessment of melt spreading in the Mark I system has been carried out using the MELTSPREAD-1 computer code together with supporting analyses. Application of MELTSPREAD-1 confirms the calculation of shell survival in a wet containment for the most probable melt release conditions from NUREG/CR-5423. According to MELTSPREAD-1, a dry containment also may not be threatened by melt spreading. This reflects the heat losses undergone by the melt in the process of spreading to the shell conservatively neglected in NUREG/CR-5423. However, there exist parameter ranges outside the most probable set where shell failure may be calculated. Accounting for the breakup and quenching of melt relocating through a deep layer of subcooled water also conservatively neglected in NUREG/CR-5423 can reduce the set of parameter variations for which containment failure is calculated in the wet case.

6705 (BNWL-CC–1367) **Radiological conditions immediately following the September 29, 1965 PRTR incident.** McConnon, D. Pacific Northwest Lab., Richland, WA (United States). Oct 1967. 19p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE92003703. Source: OSTI; NTIS (US Sales Only); GPO Dep.

On September 29, 1965, radioactive contamination was released to the containment vessel and several reactor systems of PRTR when approximately 700 grams of fuel material was lost from a ruptured fuel rod. The containment vessel immediately went into ventilation containment and remained in this condition for approximately 19 hours. During this period, one brief personnel entry was made to collect an air sample. A complete radiological survey of operating areas was made about six hours after restoration of ventilation. This report summarizes the radiological conditions observed immediately following the incident until controlled shutdown of the reactor was achieved and the situation was controlled. No attempt is made to discuss the data, only to preserve it for future reference and use. 11 figs., 5 tabs.

6706 (CONF-911079–1) **BWR lower plenum debris bed models for MELCOR.** Hodge, S.A.; Ott, L.J. Oak Ridge National Lab., TN (United States). [1991]. 25p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. From 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting; Bethesda, MD (United States); 28-30 Oct 1991. Order Number DE92001975. Source: OSTI; NTIS; INIS; GPO Dep.

Work is underway at Oak Ridge National Laboratory (ORNL) to incorporate certain models of the Boiling Water Reactor Severe Accident Response (BWRSAR) code into a local version of MELCOR. Specifically, the BWR lower plenum debris bed and bottom head response models taken from BWRSAR are being tested within the local MELCOR code structure. Upon successful completion of testing, recommendations for formal adoption of these models will be made to the Nuclear Regulatory Commission (NRC) and to the MELCOR code development staff at Sandia National Laboratories (SNL). The SNL code development staff retain exclusive responsibility for maintaining the configuration control for the official version of MELCOR. The BWR lower plenum debris bed and bottom head response models permit the calculation of heatup, melting, and relocation of the debris after dryout. They predict the response of the lower plenum internal structures and the bottom head as well as the composition and timing of material release from the vessel. They have been previously applied in severe accident analyses for the Containment Performance Improvement (CPI) Program and the Mark I shell survivability study (NUREG/CR-5423), and in recent assessments of candidate accident management strategies. This paper provides a brief description of the purpose and operation of these models. 11 refs., 15 figs., 5 tabs.

6707 (CONF-911079–6) **Progress in research on aging of structures.** Naus, D.J. (Oak Ridge National Lab., TN (United States)); Oland, C.B.; Ellingwood, B.; Mori, Y.; Arndt, E.G. Oak Ridge National Lab., TN (United States). [1991]. 63p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. From 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting; Bethesda, MD (United States); 28-30 Oct 1991. Order Number DE92002806. Source: OSTI; NTIS; INIS; GPO Dep.

The Structural Aging (SAG) Program is conducted for the Nuclear Regulatory Commission. The program has the overall objective of preparing an expandable handbook or report which will provide the NRC with potential structural safety issues and acceptance criteria for use in nuclear power plant evaluations for continued service. Initial focus of the program is on concrete and concrete-related materials which comprise the safety-related (Category I) structures in light-water reactor facilities. The program consists of a management task and three technical tasks: materials property data base, structural component assessment/repair technology, and quantitative methodology for continued service determinations. Objectives, background information, and accomplishments under each of these tasks are presented.

6708 (CONF-9110210–1) **Accident simulation and consequence analysis in support of MHTGR safety evaluations.** Ball, S.J. (Oak Ridge National Lab., TN (United States)); Wichner, R.P.; Smith, O.L.; Conklin, J.C.; Barthold, W.P. Oak Ridge National Lab., TN (United States). [1991]. 15p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. From 1991 water reactor safety meeting; Washington, DC (United States); 28-30 Oct 1991. Order Number DE92002293. Source: OSTI; NTIS; INIS; GPO Dep.

This paper summarizes research performed at Oak Ridge National Laboratory (ORNL) to assist the Nuclear Regulatory Commission (NRC) in preliminary determinations of licensability of the US Department of Energy (DOE) reference design of a standard modular high-temperature gas-cooled reactor (MHTGR). The work described includes independent analyses of core heatup and steam ingress accidents, and the reviews and analyses of fuel performance and fission product transport technology.

6709 (CONF-9111133–2) **Review of recent ORNL specific-plant analyses.** Cheverton, R.D.; Dickson, T.L. Oak Ridge National Lab., TN (United States). [1991]. 20p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. From 2. U.S./Japan specialized topic workshop on pressurized thermal shock; San Diego, CA (United States); 14 Nov 1991. Order Number DE92004222. Source: OSTI; NTIS; INIS; GPO Dep.

The Oak Ridge National Laboratory (ORNL) has been helping the Nuclear Regulatory Commission (NRC) develop the pressurized thermal shock (PTS) evaluation methodology since the mid-1970s. During the early 1980s, ORNL developed the integrated PTS (IPTS) methodology, which is a probabilistic approach that includes postulation of PTS transients, estimation of their frequencies, thermal/hydraulic analyses to obtain the corresponding thermal and pressure loadings on the reactor pressure vessel, and probabilistic fracture mechanics analyses. The scope of the IPTS program included development of the probabilistic fracture mechanics code OCA-P and application of the IPTS methodology to three nuclear plants in the US (Oconee I, Calvert Cliffs I, and H. B. Robinson II). The results of this effort were used to help establish the PTS Rule (10CFR50.61) and Regulatory Guide 1.154, which pertains to the PTS issue. The IPTS Program was completed in 1985, and since that time the ORNL related effort has been associated with long-term programs aimed at improving/updating the probabilistic fracture mechanics methodology and input data. In 1990, the NRC requested that ORNL review a vessel-integrity evaluation report submitted to the NRC by the Yankee Atomic Electric Co. for the Yankee Rowe reactor and that ORNL also perform an independent probabilistic fracture mechanics analysis. Details of the methodology and preliminary results are the subject of this paper/presentation.

6710 (DOE/DP–0091T) **Safety Evaluation Report Restart of K-Reactor Savannah River Site: Supplement 2.** USDOE Assistant Secretary for Defense Programs, Washington, DC (United States). Office of the Deputy Assistant Secretary for Facilities. Oct 1991. 82p. Sponsored by U.S. DOE Defense Programs. Order Number DE92001854. Source: OSTI; NTIS; INIS; GPO Dep.

In April 1991, the Department of Energy (DOE) issued DOE/DP-0084T, "Safety Evaluation Report Restart of K-Reactor Savannah River Site." The Safety Evaluation Report (SER) documents the results of DOE reviews and evaluations of the programmatic aspects of a large number of issues necessary to be satisfactorily addressed before restart. The issues were evaluated for compliance with the restart criteria included in the SER. The results of those evaluations determined that the restart criteria had been satisfied for some of the issues. However, for most of the issues at least part of the applicable restart criteria had not been found to be satisfied at the time the evaluations were prepared. For those issues, open or confirmatory items were identified that required resolution. In August 1991, DOE issued DOE/DP-0090T, "Safety Evaluation Report Restart of K-Reactor Savannah River Site Supplement 1." That document was the first Supplement to the April 1991 SER, and documented the resolution of 62 of the open items identified in the SER. This document is the second Supplement to the April 1991 SER. This second SER Supplement documents the resolution of additional open times identified in the SER, and includes a complete list of all remaining SER open items. The resolution of those remaining open items will be documented in future SER Supplements. Resolution of all open items for an issue indicates that its associated restart criteria have been satisfied, and that DOE concludes that the programmatic aspects of the issue have been satisfactorily addressed.

6711 (DOE/DP–0093T) **Safety evaluation report: Restart of K-Reactor Savannah River Site: Supplement 3.** USDOE Assistant Secretary for Defense Programs, Washington, DC (United States). Office of the Deputy Assistant Secretary for Facilities. Dec 1991. 95p. Sponsored by U.S. DOE Defense Programs. Order Number DE92004072. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document is the third and final Supplement to the April 1991 Safety Evaluation Report (SER) of the Savannah River Site. This third SER Supplement documents the resolution of the 121 remaining SER open items. All the restart criteria included in the SER have been satisfied for all issues.

6712 (DOE/NS–0005P) **Report of investigation into allegations of retaliation for raising safety and quality of work issues regarding Argonne National Laboratory's Integral Fast Reactor Project.** USDOE Office of Nuclear Safety, Washington, DC (United States). Dec 1991. 139p. Sponsored by U.S. DOE Nuclear Safety. Order Number DE92004953. Source: OSTI; NTIS; GPO Dep.

This report has been prepared by the Department of Energy's Office of Nuclear Safety concerning allegations made by James A. Smith, a former employee of Argonne National Laboratory-West, located near Idaho Falls, Idaho. Smith, who holds a Ph.D. in metallurgy, was employed as an associate engineer and experimenter at ANL-W from April 1988 until his resignation in August 1990. When he resigned, Smith requested DOE's Chicago Operations Office to investigate his allegations that ANL-W and ANL's Chicago-area laboratory (ANL-E) had sponsored substandard work related to ANL's Integral Fast Reactor project. (Both ANL-E and ANL-W are operated by the University of Chicago under contract to DOE). Smith alleged that the defective work included fundamental errors in metallurgy and related sciences, at least some of which had nuclear safety implications, that ANL had published false and misleading accounts of its work, and that attitudes prevailed at ANL that were antithetical to quality scientific work. Smith also alleged that as a result of expressing these concerns he was subjected to various forms of intimidation and retaliation by ANL-W managers. This report discusses the investigation, the issues, the background of the allegations, and recommendations.

6713 (EGG-M–91216) **Water-hammer in the cold leg during an SBLOCA due to cold ECCS injection.** Ortiz, M.G.; Ghan, L.S. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1991]. 4p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC07-76ID01570. (CONF-911213–17: American Society of Mechanical Engineers (ASME) annual winter meeting, Atlanta, GA (United States), 1-6 Dec 1991). Order Number DE92003321. Source: OSTI; NTIS; INIS; GPO Dep.

Water-hammer might occur in the cold leg of pressurized water reactors (PWR) during small break loss-of-coolant accidents (SBLOCA's), when cold emergency core cooling system (ECCS) water is injected into a pipe that may be partially filled with saturated steam. The water may mix with the steam and cause it to condense abruptly. Depending on the flow regime present, slugs of liquid may then be accelerated towards each other or against the piping structure. The possibility of this phenomenon is of concern to us because it may become a dominant phenomenon and change the character of the transient. In performing the code scaling, applicability, and uncertainty study (CSAU) on a SBLOCA scenario, we had to examine the possibility that the transient being analyzed could experience water-hammer and thus depart from the scope of the study. Two criteria for water-hammer initiation were investigated and tested using a RELAP5/MOD3 simulation of the transient. Our results indicated a very low likelihood of occurrence of the phenomenon. 8 refs., 6 figs.

6714 (EGG-M–91370) **Comparison of SCDAP/RELAP5/MOD3 to TRAC-PF1/MOD1 for timing analysis of PWR fuel pin failures.** Jones, K.R. (EG and G Idaho, Inc., Idaho Falls, ID (United States)); Katsma, K.R.; Wade, N.L.; Siefken, L.J.; Straka, M. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1991]. 15p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC07-76ID01570. (CONF-9111124–3: 1991 RELAP5/TRAC-B international users seminar, Baton Rouge, LA (United States), 4-8 Nov 1991). Order Number DE92003324. Source: OSTI; NTIS; INIS; GPO Dep.

A comparison has been made of SCDAP/RELAP5/MOD3- and TRAC-PF1/MOD1- based calculations of the fuel pin failure timing (time from containment isolation signal to first fuel pin failure) in a loss-of-coolant accident (LOCA). The two codes were used to calculate the thermal-hydraulic boundary conditions for a complete, double-ended, offset-shear break of a cold leg in a Westinghouse 4-loop pressurized water reactor. Both calculations used the FRAPCON-2 code to calculate the steady-state fuel rod behavior and the FRAP-T6 code to calculate the transient fuel rod behavior. The analysis was performed for 16 combinations of fuel burnups and power peaking factors extending up to the Technical Specifications limits. While all calculations were made on a best-estimate basis, the SCDAP/RELAP5/MOD3 code has not yet been fully assessed for large-break LOCA analysis. The results indicate that SCDAP/RELAP5/MOD3 yields conservative fuel pin failure timing results in comparison to those generated using TRAC-PF1/MOD1. 7 refs., 5 figs.

6715 (EGG-M–91489) **PaRaELAP: Realtime multiprocessing RELAP5.** Beelman, R.J. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1991]. 7p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC07-76ID01570. (CONF-9111124–1: 1991 RELAP5/TRAC-B international users seminar, Baton Rouge, LA (United States), 4-8 Nov 1991). Order Number DE92003322. Source: OSTI; NTIS; INIS; GPO Dep.

An effort to parallelize RELAP5 was undertaken in order to capitalize on recent computational hardware developments in achieving the goal of realtime RELAP5 simulation. The objective was attained on a Stardent Titan 750 vector-parallel machine as proof of concept during a small break loss-of-coolant accident simulation on a representative three loop Westinghouse engineering plant model. Technical considerations bearing on the objective of realtime RELAP5 simulation are presented. On-going developmental efforts are discussed. Applications to full-scope, full-fidelity simulation are advanced. 4 refs., 1 fig., 1 tab.

6716 (EGG-M–91501) **Calculation of fuel pin failure timing under LOCA conditions.** Jones, K.R.; Wade, N.L.; Siefken, L.J.; Straka, M.; Katsma, K.R. EG and G Idaho, Inc., Idaho Falls, ID (United States). Oct 1991. 24p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC07-76ID01570. (CONF-911079–9: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). Order Number DE92003308. Source: OSTI; NTIS; INIS; GPO Dep.

The objective of this research was to develop and demonstrate a methodology for calculation of the time interval between receipt of the containment isolation signals and the first fuel pin failure for loss-of-coolant accidents (LOCAs). Demonstration calculations were performed for a Babcock and Wilcox (B&W) design (Oconee) and a Westinghouse (W) 4-loop design (Seabrook). Sensitivity studies were performed to assess the impacts of fuel pin burnup, axial peaking factor, break size, emergency core cooling system (ECCS) availability, and main coolant pump trip on these items. The analysis was performed using a four-code approach, comprised of FRAPCON-2, SCDAP/RELAP5/MOD3, TRAC-PF1/MOD1, and FRAP-T6. In addition to the calculation of timing results, this analysis provided a comparison of the capabilities of SCDAP/RELAP5/MOD3 with TRAC-PF1/MOD1 for large-break LOCA analysis. This paper discusses the methodology employed and the code development efforts required to implement the methodology. The shortest time intervals calculated between initiation of containment isolation and fuel pin failure were 11.4 s and 19.1 for the B&W and W plants, respectively. The FRAP-T6 fuel pin failure times calculated using thermal-hydraulic data generated by SCDAP/RELAP5/MOD3 were more conservative than those calculated using data generated by TRAC-PF1/MOD1. 18 refs., 7 figs., 4 tabs.

6717 (EUR–13438) **Measuring process of non exceeding the limiting values for radioactive waste to be released from restricted areas.** Auler, I. (Nuklear-Ingenieur Service GmbH, Hanau (DE)); Helk, F.; Neukaeter, E.; Zimmermann, U. Commission of the European Communities, Luxembourg (Luxembourg). 1991. 86p. Contract FI1D-0062. Source: OSTI; NTIS (US Sales Only).

The dismantling of nuclear facilities requires the proof that the radioactivity of materials to be released from restricted areas remains below low limiting values. Parts which are possibly free of radioactivity would have to be disposed of as radioactive waste if a definite proof can not be demonstrated. Decision measurements are hardly possible on parts and material with complex geometry. The specific radioactivity on parts with smooth, plane and open surface is at present estimated manually by analysing representative samples or by measuring the surface of the part with beta sensitive, large-area gas flow detectors. For keeping the cost of measurements at a low level, NIS has developed a measuring device which enables the examination of large amounts of dismantled and potentially releasable components with a fast automatic procedure. The device, with nearly 4-pi detector geometry, measures the gross gamma-radiation which has a higher penetration capacity into the material than beta-radiation. The measuring device has been used since November 1988 in normal operation during the dismantling of the nuclear power plant Niederaichbach. Up to now, 100 Mg (approximately 700 measuring charges) of various dismounted materials were measured with the device for release. The examination of these measurements showed that the specified minimal detectable activity of 1000 Bq Cobalt-60 can be achieved, even with steel shielding of 2 cm thickness.

6718 (GRS-F-BL–2/1991) **List of reports in the field of reactor safety research from BMFT, CEA, EPRI, JSTA and US-NRC. Reported period: April 1 to June 30, 1991.** Gesellschaft fuer Reaktorsicherheit mbH (GRS), Koeln (Germany). Aug 1991. 55p. (In German). Order Number DE92750163. Source: OSTI; NTIS (US Sales Only); INIS.

This list reviews reports from the Federal Republic of Germany, from France, from Japan and from the United States of America concerning single problems in the field of reactor safety research. According to the cooperation of the Bundesminister fuer Forschung und Technologie (BMFT) with the Commissariat a l'Energie Atomique (CEA), the Japan Science and Technology Agency (JSTA), the Electric Power Research Institute (EPRI) and the United States Nuclear Regulatory Commission, these reports are available in the Gesellschaft fuer Reaktorsicherheit (GRS). The list pursues the following order: Country of origin, problem area concerned, according to the Reactor Safety Research Program of the BMFT, reporting organization. The list of reports appears quarterly. (orig./HP).

6719 (HW–32630-Del.) **A bibliography of reactor hazards.** Steach, R.L. (comp.). General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 2 Aug 1954. 63p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE92003721. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This annotated bibliography contains 109 references to the classified report literature on the liability of reactors to disaster, the possible consequences of disaster, and reactor accidents which have occurred. The references are arranged alpha-numerically, which is essentially by issuing site. An author index, a subject index, and a report number index are included. The subject index references the reports both by the reactor affected and the potential hazard. The report number index contains both primary and secondary numbers of the reports.

6720 (HW–34847-Pt.14) **KW reactor incident—investigation record: Informational memoranda (Prepared for the committee by Reactor Section personnel).** General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 11 Feb 1955. 48p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-87RL10930. Order Number DE92001735. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This document provides informational memoranda prepared by reactor section personnel for the investigating committee in regard to the KW Reactor incident investigation. (FI)

6721 (HW–63996) **Coulee disaster report.** Corley, J.P. General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation. 12 Sep 1957. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE92002887. Source: OSTI; NTIS (US Sales Only); GPO Dep.

In attempting to assess the hazard to Hanford reactor areas resulting from enemy attack at Ground Coulee, there is one main factor – the size of the breach – plus a host of less important factors. Some of these factors are subject to analysis and calculation, however rough; unfortunately the size of the breach is not. It is thought, however, that additional information as a result of atomic weapon testing in the six years since the original Corps of Engineers report was issued may enable a more reliable and perhaps a more optimistic estimate to be made by a qualified consultant. No other reasonable modifications are foreseen that would affect significantly the previous estimates of damage to be expected in event of a Coulee disaster. Appendix A shows a proposed program of action. Appendix B shows calculated flood levels at HAPO from varying sizes of breaching. 7 refs., 1 fig.

6722 (INIS-BR–2870) **Preoperational radiation measurements at the Angra-I nuclear power plant. Part 1.** Leao, J.L.B.; Barbosa, W.P.; Oberhofer, M. Instituto de Radioprotecao e Dosimetria (IRD), Rio de Janeiro, RJ (Brazil). [1991] 14p. Order Number DE92614964. Source: OSTI; NTIS (US Sales Only); INIS.

During December 10 and 11, 1980, γ-background measurements were performed at the Angra-I nuclear power plant within the reactor containment, within and outside the adjacent building complexes. The dose-rates within the containment averaged around 10,6 μR/h, within the auxiliary building around 14,4 μR/h. The lowest values, 6 μR/h, were measured within the reactor coolant pump and steam generator compartments, the highest value, 25 μR/h, in the charging pump valve operation room, elevation 8,65, close to area monitor No. 4. (author).

6723 (INIS-GB–384) **Nuclear emergencies.** At-A-Glance series. National Radiological Protection Board, Chilton (United Kingdom). 1991 6p. Order Number DE92614965. Source: OSTI; NTIS (US Sales Only); INIS.

Fold-out leaflet.

This leaflet, which is in the form of a fold-up chart, has panels of text which summarize the emergencies that could arise and the countermeasures and emergency plans that have been prepared should nuclear accident occur or affect the United Kingdom. The levels of radiation doses at which various measures would be introduced are outlined. The detection and monitoring programmes that would operate is illustrated. The role of NRPB and the responsible government departments are set out together with an explanation of how the National Arrangements for Incidents involving Radioactivity would be coordinated. (UK).

6724 (JAERI-M–91-103) **A BWR pump suction-line 200% break test at ROSA-III Program (RUN 903): Effect of prolonged recirculation pump operation.** Suzuki, Mitsuhiro (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Nakamura, Hideo; Yonomoto, Taisuke; Kumamaru, Hiroshige; Anoda, Yoshinari; Murata, Hideo. Japan Atomic Energy Research Inst., Tokyo (Japan). Jul 1991. 177p. Order Number DE92750950. Source: OSTI; NTIS (US Sales Only); INIS.

The Rig-of-Safety Assessment (ROSA)-III Program conducted a 200% recirculation pump-suction line break test, RUN 903, simulating a loss-of-coolant accident (LOCA) in a boiling water reactor (BWR). In this test, the main recirculation pumps (MRPs) were continuously operated during the transient following the break to study the influence of increased core flow rate on the system responses. This report describes major thermal-hydraulic phenomena observed in this test and presents all the experiment data. The effects of prolonged pump operation on system responses are described in comparison with the results of standard 200% break test, RUN 926, in which the core flow coasted down after the break faster than a scaled BWR LOCA condition. It is shown that the significant core heatup observed during the early blow-down phase in RUN 926 was not observed in RUN 903 due to an additional mass transport (approximately 6% of the initial system mass) from the downcomer into the core shroud as a result of the prolonged pump operation. It is clear that the lower-than-scaled transient core flow rate in the ROSA-III tests significantly affected the core thermal conditions especially during the early blowdown phase. (author).

6725 (JAERI-M–91-128) **Fission product release analysis code during accident conditions of HTGR, RACPAC.** Sawa, Kazuhiro (Japan Atomic Energy Research Inst., Oarai, Ibaraki (Japan). Oarai Research Establishment); Tazawa, Yujiro; Itakura, Hirofumi. Japan Atomic Energy Research Inst., Tokyo (Japan). Aug 1991. 39p. (In Japanese). Order Number DE92750959. Source: OSTI; NTIS (US Sales Only); INIS.

Fission product release analysis code, RACPAC (Fission Product Release Analysis Code from Fuel Particle in Accident Condition), was developed to calculate fractional release from the core during accident conditions of High Temperature Gas-cooled Reactor. RACPAC code has following features. (1) Fission product release fraction after the reactor scram is calculated based on the analytical solution with reduced diffusion coefficient. (2) The reduced diffusion coefficient for each nuclide is calculated from the (R/B) value, which is defined as release rate to birth rate of fission product. (3) The temperature transient after the accident can be taken into consideration in fractional release calculation with RACPAC. This paper describes calculation model of fission product release from fuel particle, calculation model of the reduced diffusion coefficient, users' manual and calculation examples. (author).

6726 (KAERI/RR–954/90) **Development of a computer code concerning the diffusion of radioactive effluents and radiological exposure following an accident.** Lee, Young Bok (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Kim, Byung Woo; Han, Moon Hee; Kim, Eun Han; Hwang, Won Tae. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1991. 184p. (In Korean). Order Number DE92615198. Source: OSTI; NTIS (US Sales Only); INIS.

Cheap and clean energy can be supplied with nuclear power plant whose accident probability is very low comparing with that of the other industrial facilities. However, the consequences of severe accident of nuclear power plant may result in a critical impact on population and ecosystem over a wide area due to the radioactive effluents released into the atmosphere as was in the case of the Chernobyl accident. Therefore, it is necessary to prepare an effective computer analysis system for real-time dose assessment against a potential severe accident of nuclear facility. The objective of this study is a development of the real-time assessment system of environmental exposure dose in an emergency and the installation of its prototype system. Wind field model satisfying the mass conservation and Monte Carlo diffusion model to save computing time were developed in order to assess real-time diffusion of radioactive effluents in an accident. Comparing studies were done in

3 kinds of typical topographic situation dependent on every atmospheric stability. Data library of exposure doses was documented by several computer calculation so that computation time could be reduced considerably. These results of the computation with data library showed a good agreement with the real calculation by the existing mode in which numerical integration model was used. And a graphic package was established that enabled to display the wind vector, concentration field of radioactives, and distribution of exposure dose every time step on the color graphic terminal. Work station was composed of host computer CDC-CYBER, graphic application processor - TEK 4301, graphic CRT - TEK 4125 and hard copier - TEK 4693 D. (Author).

6727 (KFK–4827) **Zircaloy oxidation and cladding deformation in PWR-specific CORA experiments.** Minato, K. (Japan Atomic Energy Research Inst. (JAERI), Tokai-Mura (Japan)); Hering, W.; Hagen, S. Kernforschungszentrum Karlsruhe GmbH (Germany). Hauptabteilung Ingenieurtechnik; Kernforschungszentrum Karlsruhe GmbH (Germany). Projekt Nukleare Sicherheitsforschung. Jul 1991. 105p. Order Number DE92750150. Source: OSTI; NTIS (US Sales Only); INIS.

Out-of-pile bundle experiments (zircaloy 4) are performed in the CORA facility to investigate the behavior of PWR fuel elements during severe fuel damage (SFD) accidents. Within the international cooperation the most significant phenomena such as cladding deformation, oxidation (especially the zirconium/steam reaction), melt formation, melt release, and relocation which were found in all tests have been analyzed. (orig./MM).

6728 (KFK–4850) **Safety oriented LWR research. Annual report 1990.** Kernforschungszentrum Karlsruhe GmbH (Germany). Projekt Nukleare Sicherheitsforschung. Jul 1991. 270p. (In German). Order Number DE92758922. Source: OSTI; NTIS (US Sales Only); INIS.

The contributions describe phenomenons of severe fuel damage and aspects of core meltdown accidents. These accidents deal with aerosol behaviour and ventilation systems and the methods for assessing and reducing the radiological concequences of nuclear accidents. Other contributions describe selected questions of safety of HCLWR type reactors. (DG).

6729 (KFK–4850, pp. 59-65) **Measurement of gas components in CORA-experiments.** Huber, R. (Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Neutronenphysik und Reaktortechnik); Schub, I.; Schumacher, G.; Malauschek, H. Kernforschungszentrum Karlsruhe GmbH (Germany). Projekt Nukleare Sicherheitsforschung. Jul 1991. (In German). In *Safety oriented LWR research. Annual report 1990.* 270p. Order Number DE92758922. Source: OSTI; NTIS (US Sales Only); INIS.

Quantitative on line analysis of reaction product and sweep gases has been conducted at CORA-7, -13, and -18 experiments by means of quadrupole mass spectrometry. Data obtained allow estimation of the degree of reaction of the steam-water mixture with zircaloy and absorber materials and also the production rate of hydrogen. In CORA-7, which employed a simulation of a PWR-type bundle, the peak production rate of hydrogen was 0.19 g/sec and the total hydrogen production 114 g. The respective values in CORA-18, a BWR-type experiment, were 0.2 g/sec and 106 g total. Improvement of the dilution chamber, that is placed in the line between the gas probe at the bundle exit and one of the two mass spectrometers, allowed a quantitative analysis of hydrogen and water vapour also via this line, which could not be achieved in former experiments. (orig./DG).

6730 (KFK–4850, pp. 66-76) **Aerosol behaviour under core meltdown accident conditions.** Bunz, H. (Kernforschungszentrum Karlsruhe GmbH (Germany). Lab. fuer Aerosolphysik und Filtertechnik 1); Koyro, M.; Propheter, B.; Schoeck, M.; Wagner-Ambs, M. Kernforschungszentrum Karlsruhe GmbH (Germany). Projekt Nukleare Sicherheitsforschung. Jul 1991. (In German). In *Safety oriented LWR research. Annual report 1990.* 270p. Order Number DE92758922. Source: OSTI; NTIS (US Sales Only); INIS.

The REST-program investigating the fission product release from the sump pool during severe accidents in LWRs was completed. Measurements were performed with $BaSO_4$-suspensions representing the insoluble fractions of the aerosols deposited in the sump water in addition to the already finished experiments with solutions. In contrast to the results with solutions the release rate does not depend on the sump concentration indicating saturation of the suspended material on the surfaces of the rising bubbles. The ratio between the resuspension factors of suspensions and solutions is about 3.5 to 42. (orig./DG).

6731 (KFK–4850, pp. 77-97) **Behaviour of a core melt in the LWR containment.** Alsmeyer, H. (Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Reaktorbauelemente); Foit, J.J.; Schneider, H.; Stiefel, S.; Tromm, W.; Merkel, G.; Ratajczak, W.; Seibert, J.; Schoenthal, H.; Ziegler, H. Kernforschungszentrum Karlsruhe GmbH (Germany). Projekt Nukleare Sicherheitsforschung. Jul 1991. (In German). In *Safety oriented LWR research. Annual report 1990.* 270p. Order Number DE92758922. Source: OSTI; NTIS (US Sales Only); INIS.

Two experiments on melt-concrete interaction have been carried out in the BETA facility to investigate the special influence of high Zirconium content in the metal phase and its consequences on aerosol release. Both experiments show a dominance of Zr oxidation in the first 2 or 3 minutes of the interaction accompanied by high gas release (predominantly hydrogen), high concrete erosion rate, and high void level in the melt. The early chemical energy release mainly from the reaction of the Zirconium with the silicon of the melting concrete is considerably higher than the electrical heating rate to simulate the decay heat in the melt. The aerosol release from the melt is strongly decreasing with time, where the early high aerosol release is coupled with the presence of Zr metal. Selected simulated fission products have been added to the melt in different chemical compositions. (orig./DG).

6732 (KFK–4850, pp. 98-100) **Measurement of gas components in BETA-experiments.** Huber, R. (Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Neutronenphysik und Reaktortechnik); Schub, I.; Schumacher, G. Kernforschungszentrum Karlsruhe GmbH (Germany). Projekt Nukleare Sicherheitsforschung. Jul 1991. (In German). In *Safety oriented LWR research. Annual report 1990.* 270p. Order Number DE92758922. Source: OSTI; NTIS (US Sales Only); INIS.

Quantitative on line analysis of reaction product and sweep gases has been conducted at BETA experiments by means of quadrupole mass spectrometry. Data obtained allow estimation of the reaction gases during the interaction of a simulated core melt with concrete. The main gases that develop during this interaction are hydrogen and water vapour. Other gases that appear are carbon monoxide, carbon dioxide and a small amount of methane. During the course of the experiment gas production is high in the first minutes and continues at relatively low levels later in time. Plots of the integrated gas release versus time are given in the report. (orig./DG).

6733 (KFK–4850, pp. 1-30) **Out-of-pile bundle experiments for the investigation of severe fuel damage (CORA program): Tests CORA-7 and CORA-18 (large bundles).** Hagen, S. (Kernforschungszentrum Karlsruhe GmbH (Germany). Hauptabteilung Ingenieurtechnik); Gruenhagen, A.; Heine, R.; Malauschek, H.; Mueller, G.; Paroth, G.; Seibert, F.; Leopold, L.; Wallenfels, K.P.; Benz, H.; Giessmann, H.; Grehl, C.; Heil, O.; RoetzKernforschungszentrum Karlsruhe GmbH (Germany). Projekt Nukleare Sicherheitsforschung. Jul 1991. (In German). In *Safety oriented LWR research. Annual report 1990.* 270p. Order Number DE92758922. Source: OSTI; NTIS (US Sales Only); INIS.

Out-of-pile bundle experiments with electrically heated rods are performed in the CORA-facility. Eleven tests with UO_2 pellets were run up to the end of 1990; i.e. eight on PWR and three on BWR fuel element behavior. In the test arrangement for the larger bundles the identical fuel rod simulators as in normal bundles were used. Absorber rods (stainless steel sheathed AgInCd within Zry guide tubes for PWR and B_4C with stainless steel sheath within Zry channel box walls) and spacers (Inconel + Zircaloy) are included, to allow realistic interactions between the fuel element components. The tests were terminated below 2000deg C to better investigate the initial melt movement and the composition of the resulting phases. The temperature escalation continuated even after the shutdown of the steam supply and electric power as long as enough steam was left in the bundle. In principle the escalation behavior turned out to be independent of the bundle size. (orig./DG).

6734 (KFK–4850, pp. 31-51) **Mechanical and chemical behaviour of LWR fuel rod bundles at high temperatures.** Hofmann, P. (Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Material- und Festkoerperforschung 1 - Teilinstitut Kernbrennstoffe); Markiewicz, M.; Garcia, E.A.; Burbach, J.; Metzger, H. Kernforschungszentrum Karlsruhe GmbH (Germany). Projekt Nukleare Sicherheitsforschung. Jul 1991. (In German). In *Safety oriented LWR research. Annual report 1990.* 270p. Order Number DE92758922. Source: OSTI; NTIS (US Sales Only); INIS.

The chemical behaviour of the various PWR absorber rod components has been studied at temperatures up to 1200deg C. The reaction kinetics has been determined for the systems (Ag, In, Cd) absorber/Zircaloy-4 and Zircaloy-4/stainless steel 1.4919 (AISI 316). The interactions can be described by parabolic rate laws; the Arrhenius equations for the various interactions are given. The results of all the single-effects tests and integral CORA experiments performed to date have been used to define three distinct temperature regions in which liquid phases form. The liquid phases contribute essentially to the damage initiation and propagation of the fuel rod bundles. The interpretation of the available results and their impact on possible accident management measures has been described. (orig./DG).

6735 (KFK–4850, pp. 52-58) **Post-test examination and evaluation of the CORA experiments.** Leistikow, S. (Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Material- und Festkoerperforschung 2 - Teilinstitut Huell- und Strukturmaterialien); Schanz, G. Kernforschungszentrum Karlsruhe GmbH (Germany). Projekt Nukleare Sicherheitsforschung. Jul 1991. (In German). In *Safety oriented LWR research. Annual report 1990.* 270p. Order Number DE92758922. Source: OSTI; NTIS (US Sales Only); INIS.

The bundles from the CORA-2 and CORA-3 Severe Fuel Damage (SFD) experiments, consisting of 9 unheated fuel rods and 16 electrically heated simulators, together with an Inconel spacer grid at middle elevation, have been evaluated on the basis of an extensive optical and SEM-analytical investigation of collected samples and selected cross sections. The results take into account measurements and visual observations during the tests as well as informations from single-effects investigations. In the present contribution the CORA-2 and CORA-3 fuel rod bundle degradation is interpreted by a short description of the pertinent phenomena, their causal mechanisms and their mutual interference. (orig./DG).

6736 (KFK–4850, pp. 101-108) **Core meltdown experiments BETA.** Dillmann, H.G. (Kernforschungszentrum Karlsruhe GmbH (Germany). Lab. fuer Aerosolphysik und Filtertechnik 2); Pasler, H.; Schmitt, H. Kernforschungszentrum Karlsruhe GmbH (Germany). Projekt Nukleare Sicherheitsforschung. Jul 1991. (In German). In *Safety oriented LWR research. Annual report 1990.* 270p. Order Number DE92758922. Source: OSTI; NTIS (US Sales Only); INIS.

In the BETA facility two experiments of a simulated core melt with concrete were done. Two aerosol-sampling stations and the off-gas aerosol filter system were handled. In the last experiment 1,5 kg of aerosol mass were filtered. (orig./DG).

6737 (KFK–4850, pp. 145-166) **Development of methods for assessing and reducing the radiological consequences of nuclear accidents.** Burkart, K. (Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Neutronenphysik und Reaktortechnik); Commard, A.C.; Ehrhardt, J.; Faude, D.; Fischer, F.; Hasemann, I.; Kazakis, I.; Paesler-Sauer, J.; Qu, J.; Steinhauer, C.; Kunze, R.; Meyer, D.; RaKernforschungszentrum Karlsruhe GmbH (Germany). Projekt Nukleare Sicherheitsforschung. Jul 1991. (In German). In *Safety oriented LWR research. Annual report 1990.* 270p. Order Number DE92758922. Source: OSTI; NTIS (US Sales Only); INIS.

The program package COSYMA (Code system from MARIA) for assessing the off-site consequences of accidental releases of radioactivity from nuclear installations to atmosphere has been completed in cooperation with NRPB (U.K.). The development of the computer-aided decision support system RESY was concentrated on the completion of the hardware and the coding of the framework system BASY. Based on the operation system UNIX, service programs control and maintain the data flow and the access to the various subsystems, and allow the communication with the user via X-window graphic terminals. The Gaussian-puff models ATSTEP has been developed for calculating actual and forecasted time and space dependent concentration fields based on predicted meteorological data. After its implementation into the subsystem RSY, activity concentration and potential organ dose fields can be updated in a 10 min interval and presented in the form of isolines or contamination patterns. (orig./DG).

6738 (KFK–4850, pp. 228-252) **Investigations of the reflooding behaviour in tight lattice rod bundles in the frame of the FLORESTAN-program.** Wiehr, K. (Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Reaktorbauelemente); Erbacher, F.J.; Just, W.; Schmidt, H. Kernforschungszentrum Karlsruhe GmbH (Germany). Projekt Nukleare Sicherheitsforschung. Jul 1991. (In German). In *Safety oriented LWR research. Annual report 1990.* 270p. Order Number DE92758922. Source: OSTI; NTIS (US Sales Only); INIS.

This report describes results of forced feed flooding experiments gained on a wider triangular lattice rod bundle. The rod pitch over diameter ratio (p/d) is 1.24. This type of bundle represents a fuel element design of a homogenous APWR. The test bundle consists of 61 fuel rod simulators with Zircaloy-claddings and special grid spacers for a triangular lattice. The heater of the fuel rod simulator is characterized by a cosine shaped axial power profile with a power peaking factor of 1.3 and a heated length of about two meters. The results show that the thermal hydraulic behavior of such an array under forced feed flooding conditions is simular to that of a PWR-geometry. (orig./DG).

6739 (KFK–4850, pp. 253-260) **Long term coolability of a core melt.** Alsmeyer, H. (Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Reaktorbauelemente); Schneider, H.; Tromm, W. Kernforschungszentrum Karlsruhe GmbH (Germany). Projekt Nukleare Sicherheitsforschung. Jul 1991. (In German). In *Safety oriented LWR research. Annual report 1990.* 270p. Order Number DE92758922. Source: OSTI; NTIS (US Sales Only); INIS.

One of the problems which must be solved in severe accidents is the melt concrete interaction which does occur when the core debris penetrates the lower pressure vessel head and contacts the basement. To prevent these accident consequences a core catcher concept is proposed to be integrated into the new PWR design. The core catcher consists of a perforated steel plate covered with a sacrificial layer and is connected with the basement by a supporting structure. In case of an accident the interfacial gap under the bottom plate is filled with sumpwater. In the sacrificial layer melt plugs are inserted which are the extension of the holes in the bottom steel plate. When the core melt erodes the layer, the plugs open by melting, and water/steam flow through the plugs and the melt starts. This continuous cooling stabilizes the melt and finally allows flooding of the upper melt surface. In order to identify the dominant processes during flooding of the melt from the bottom, two prototypic experiments in laboratory scale have been carried out. (orig.).

6740 (KFK–4891) **Experiments on thermal interactions: Tests with Al_2O_3 droplets and water.** Peppler, W.; Till, W.; Kaiser, A. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Reaktorentwicklung (IRE); Kernforschungszentrum Karlsruhe GmbH (Germany). Projekt Nukleare Sicherheitsforschung. Sep 1991. 91p. Order Number DE92750188. Source: OSTI; NTIS (US Sales Only); INIS.

Within the analysis of severe highly hypothetical fast breeder accidents the consequences of a fuel-coolant interaction have to be considered, i.e. the thermal interaction between hot molten fuel and sodium. To improve principal knowledge on the fragmentation process during the interaction of a hot droplet with a cold fluid, a series of experiments was performed with single droplets of molten Al_2O_3 as the hot liquid and water as the cold and easily volatile fluid. To initiate fragmentation of the droplet pressure pulses of up to 1 MPa were generated in the water by a magnetic hammer. The events were filmed by a high speed camera with up to 10^5 pictures per second. Details of the interactions can be deduced from the films and from the pressure histories. The existence of a vapour trail in all experiments indicates complex heat and mass transfer processes occurring in the vapour film spontaneously formed between droplet and cold fluid. Fragmentation was initiated by local events in the vapour trail area. (orig.).

6741 (NUREG–0847-Suppl.7) **Safety evaluation report related to the operation of Watts Bar Nuclear Plant, Units 1 and 2 (Docket Nos. 50-390 and 50-391): Supplement No. 7.** Tam, P.S. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Reactor Projects I/II. Sep 1991. 59p. Sponsored by Nuclear Regulatory Commission. Source: OSTI; NTIS; INIS; GPO.

This report supplements the Safety Evaluation Report (SER), NUREG- 0847 (June 1982), Supplement No. 1 (September 1982), Supplement No. 2 (January 1984), Supplement No. 3 (January 1985), Supplement No. 4 (March 1985), Supplement No. 5 (November 1990), and Supplement No. 6 (April 1991) issued by the Office of Nuclear Reactor Regulation of the US Nuclear Regulatory Commission with respect to the application filed by the Tennessee Valley Authority, as applicant and owner, for licenses to operate the Watts Bar Nuclear Plant, Units 1 and 2 (Docket Nos. 50-390 and 50-391). The facility is located in Rhea County, Tennessee, near the Watts Bar Dam on the Tennessee River. This supplement provides recent information regarding resolution of some of the outstanding and confirmatory items, and proposed license conditions identified in the SER.

6742 (NUREG–1435-Suppl.1) **Status of safety issues at licensed power plants: TMI action plan requirements, unresolved safety issues, generic safety issues: Supplement 1.** Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Reactor Regulation. Dec 1991. 101p. Sponsored by Nuclear Regulatory Commission. Source: OSTI; NTIS; INIS; GPO.

As part of ongoing US Nuclear Regulatory Commission (NRC) efforts to ensure the quality and accountability of safety issue information, a program was established whereby an annual NUREG report would be published on the status of licensee implementation and NRC verification of safety issues in major NRC requirements areas. This information was compiled and reported in three NUREG volumes. Volume 1, published in March 1991, addressed the status of of Three Mile Island (TMI) Action Plan Requirements. Volume 2, published in May 1991, addressed the status of unresolved safety issues (USIs). Volume 3, published in June 1991, addressed the implementation and verification status of generic safety issues (GSIs). This annual NUREG report combines these volumes into a single report and provides updated information as of September 30, 1991. The data contained in these NUREG reports are a product of the NRC's Safety Issues Management System (SIMS) database, which is maintained by the Project Management Staff in the Office of Nuclear Reactor Regulation and by NRC regional personnel. This report is to provide a comprehensive description of the implementation and verification status of TMI Action Plan Requirements, safety issues designated as USIs, and GSIs that have been resolved and involve implementation of an action or actions by licensees. This report makes the information available to other interested parties, including the public. An additional purpose of this NUREG report is to serve as a follow-on to NUREG-0933, "A Prioritization of Generic Safety Issues," which tracks safety issues up until requirements are approved for imposition at licensed plants or until the NRC issues a request for action by licensees.

6743 (NUREG/CP–0114-Vol.2, pp. 433-448) **Failure of PWR-RHRS under cold shutdown conditions: Experimental results from the PKL test facility.** Mandl, R.M. (Siemens AG, Erlangen (West Germany)); Umminger, K.J.; Logt, J.V.D. Nuclear Regulatory Commission, Washington, DC (United States). Office of Nuclear Regulatory Research; Brookhaven National Lab., Upton, NY (United States). Apr 1991. (CONF-9010185–Vol.2: 18. water reactor safety information meeting, Rockville, MD (United States), 22-24 Oct 1990). In *Eighteenth water reactor safety information meeting. Volume 2, Severe accident research, accident management, probabilistic risk assessment topics, individual plant examination program and other issues.* 578p. Source: OSTI; NTIS; INIS; GPO.

The Residual Heat Removal System (RHRS) of a PWR is designed to transfer thermal energy from the core after plant shutdown and maintain the plant in cold shutdown or refuelling conditions for extended periods of time. Initial reactor cooling after shutdown is achieved by dissipating heat through the steam generators (SGs) and discharging steam to the condenser by means of the Turbine Bypass System (TBS). When the reactor coolant temperature has dropped to about 160C and pressure has been reduced to 30 bar the RHRS is placed into operation. it reduces the coolant temperature to 50C within 20 hours after shutdown. The time margin for establishing alternate methods of heat removal following a failure of the RHRS depends on the Reactor Coolant System (RCS) temperature, the decay heat rate and the amount of RCS inventory. During some shutdown operations the RCS may be partially drained (e. g. to perform SG inspections). Decreased primary system inventory can significantly reduce the time available to recover the RHRS's function prior to bulk boiling and possible core uncovery. In the PKL test facility, which simulates a 1,300 MWe 4-loop PWR on a scale 1:145, a failure of RHRS under cold shutdown conditions was performed. This presentation gives a brief description of the test facility followed by the test objectives and results of this experiment.

6744 (NUREG/CR–5382) **Screening of generic safety issues for license renewal considerations.** Faramarzi, A. (Mitre Corp., McLean, VA (United States)); Hughes, A.A.; Seth, S.S. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Safety Issue Resolution; Mitre Corp., McLean, VA (United States). Dec 1991. 74p. Sponsored by Nuclear Regulatory Commission. (MTR–90W00467). Source: OSTI; NTIS; INIS; GPO.

The US Nuclear Regulatory Commission (NRC) is developing regulations for renewing the operating licenses of nuclear power plants to ensure that they operate safely beyond the present license terms of 40 years. One consideration relates to past resolutions of generic safety issues (GSIs) that did not result in backfit requirements on the licensees. The consideration of an additional operating term of 20 years which the proposed license renewal rule allows, could have retrospective implication for the basis of those GSI resolutions. As part of its technical support to the NRC for the development of license renewal regulations. MITRE has performed an independent review of the GSIs to identify those that could be potentially affected by license renewal considerations. This report describes the screening process and the results of that work.

6745 (NUREG/CR–5520) **Procedures guide for extracting and loading probabilistic risk assessment data into MAR-D using IRRAS 2.5.** Fowler, R.D. (EG and G Idaho, Inc., Idaho Falls, ID (United States)); Judd, D.L.; Pham, M.; VanHorn, R.L.; Wolfram, L.M. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Safety Issue Resolution; EG and G Idaho, Inc., Idaho Falls, ID (United States). Nov 1991. 99p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC07-76ID01570. (EGG–2630). Source: OSTI; NTIS; GPO.

The Models and Results Data Base (MAR-D) can be used to organize information from probabilistic risk assessments (PRAs). Data may be entered into MAR-D electronically or manually. This report concentrates on manual data-entry methods and documents the use of the Integrated Reliability and Risk Analysis System (IRRAS), Version 2.5, and ASCII text editors to load level 1 (internal event) PRA models into MAR-D. Step-by-step instructions for using IRRAS 2.5 are provided, which will help the user transfer data from a printed (hardcopy) source to MAR-D.

6746 (NUREG/CR–5623) **BWR Mark II ex-vessel corium interaction analyses.** Greene, S.R. (Oak Ridge National Lab., TN (United States)); Levin, A.E.; Hyman, C.R.; Sozer, A.; Taleyarkhan, R.P. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Safety Issue Resolution; Oak Ridge National Lab., TN (United States). Nov 1991. 214p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. (ORNL/TM–11644). Source: OSTI; NTIS; INIS; GPO.

This report describes the results of a series of studies conducted to investigate the behavior of core debris within a BWR Mark II containment. These studies focused on the interaction of core debris with concrete and steel structures (downcomers and inpedestal floor drains) within the drywell, the transport of debris through these drains and downcomers into the wetwell, and on debris-water reactions within the wetwell. Estimates of the conditions under which debris would penetrate the in-pedestal drain lines, the time-dependent behavior of the debris within the drain lines, and the amount of debris which might enter the suppression pool via these drain lines are provided. An assessment of the conditions under which the upper lip of the downcomers would be expected to fail (i.e. melt) due to exposure to hot core debris is presented. Finally, the unique characteristics of debris water interactions in Mark II containments are discussed, the existing knowledge base regarding core-concrete debris-water interactions is summarized, and an evaluation of the applicability of the MELCOR 1.80 code's debris-water interaction model to BWR Mark II's is presented.

6747 (NUREG/CR–5712) **MORECA: A computer code for simulating modular high-temperature gas-cooled reactor core heatup accidents.** Ball, S.J. (Oak Ridge National Lab., TN (United States)). Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Oak Ridge National Lab., TN (United States). Oct 1991. 63p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. (ORNL/TM–11823). Source: OSTI; NTIS; INIS; GPO.

The design features of the modular high-temperature gas-cooled reactor (MHTGR) have the potential to make it essentially invulnerable to damage from postulated core heatup accidents. This report describes the ORNL MORECA code, which was developed for analyzing postulated long-term core heatup scenarios for which active cooling systems used to remove afterheat following the accidents can be assumed to the unavailable. Simulations of long-term loss-of-forced-convection accidents, both with and without depressurization of the primary coolant, have shown that maximum core temperatures stay below the point at which any significant fuel failures and fission product releases are expected. Sensitivity studies also have been done to determine the effects of errors in the predictions due both to uncertainties in the modeling and to the assumptions about operational parameters. MORECA models the US Department of Energy reference design of a standard MHTGR.

6748 (NUREG/CR–5728) **Experiments to investigate the effect of flight path on direct containment heating (DCH) in the Surtsey test facility: The Limited Flight Path (LFP) tests.** Allen, M.D. (Sandia National Labs., Albuquerque, NM (United States)); Pilch, M.; Griffith, R.O.; Nichols, R.T. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Systems Research; Sandia National Labs., Albuquerque, NM (United States). Oct 1991. 97p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC04-76DP00789. (SAND–91-1105). Source: OSTI; NTIS; INIS; GPO.

The goal of the Limited Flight Path (LFP) test series was to investigate the effect of reactor subcompartment flight path length on direct containment heating (DCH). The test series consisted of eight experiments with nominal flight paths of 1, 2, or 8 m. A thermitically generated mixture of iron, chromium, and alumina simulated the corium melt of a severe reactor accident. After thermite ignition, superheated steam forcibly ejected the molten debris into a 1:10 linear scale the model of a dry reactor cavity. The blowdown steam entrained the molten debris and dispersed it into the Surtsey vessel. The vessel pressure, gas temperature, debris temperature, hydrogen produced by steam/metal reactions, debris velocity, mass dispersed into the Surtsey vessel, and debris particle size were measured for each experiment. The measured peak pressure for each experiment was normalized by the total amount of energy introduced into the Surtsey vessel; the normalized pressures increased with lengthened flight path. The debris temperature at the cavity exit was about 2320 K. Gas grab samples indicated that steam in the cavity reacted rapidly to form hydrogen, so the driving gas was a mixture of steam and hydrogen. These experiments indicate that debris may be trapped in reactor subcompartments and thus will not efficiently transfer heat to gas in the upper dome of a containment building. The effect of deentrainment by reactor subcompartments may significantly reduce the peak containment load in a severe reactor accident. 8 refs., 49 figs., 6 tabs.

6749 (NUREG/CR–5765) **SPARC-90: A code for calculating fission product capture in suppression pools.** Owczarski, P.C. (Pacific Northwest Lab., Richland, WA (United States)); Burk, K.W. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications; Pacific Northwest Lab., Richland, WA (United States). Oct 1991. 81p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC06-76RL01830. (PNL–7723). Source: OSTI; NTIS; INIS; GPO.

This report describes the technical bases and use of two updated versions of a computer code initially developed to serve as a tool for calculating aerosol particle retention in boiling water reactor (BWR) pressure suppression pools during severe accidents, SPARC-87 and SPARC-90. The most recent version is SPARC-90. The initial or prototype version (Owczarski, Postma, and Schreck 1985) was improved to include the following: rigorous treatment of local particle deposition velocities on the surface of oblate spherical bubbles, new correlations for hydrodynamic behavior of bubble swarms, models for aerosol particle growth, both mechanistic and empirical models for vent exit region scrubbing, specific models for hydrodynamics of bubble breakup at various vent types, and models for capture of vapor iodine species. A complete user's guide is provided for SPARC-90 (along with SPARC-87). A code description, code operating instructions, partial code listing, examples of the use of SPARC-90, and summaries of experimental data comparison studies also support the use of SPARC-90. 29 refs., 4 figs., 11 tabs.

6750 (NUREG/CR–5781) **Summary of a workshop on severe accident management for PWRs.** Kastenberg, W.E. (ed.) (California Univ., Los Angeles, CA (United States). Dept. of Mechanical, Aerospace and Nuclear Engineer); Apostolakis, G.; Jae, M.; Milici, T.; Park, H.; Xing, L.; Dhir, V.K.; Lim, H.; Okrent, D.; Swider, J.; Yu, D. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Systems Research; California Univ., Los Angeles, CA (United States). Dept. of Mechanical, Aerospace and Nuclear Engineering. Nov 1991. 53p. Sponsored by Nuclear Regulatory Commission. Source: OSTI; NTIS; INIS; GPO.

Severe accident management can be defined as the use of existing and/or alternative resources, systems and actions to prevent or mitigate a core-melt accident. For each accident sequence and each combination of strategy, there may be several options available to the operator; and each involves phenomenological and operational considerations regarding uncertainty. Operational uncertainty includes operator, system and instrument behavior during severe accidents. During the period May 15–17, 1990 a workshop was held at the University of California, Los Angeles, to address these uncertainties for pressurized water reactors (PWRs). This report contains a summary of the workshop proceedings.

6751 (ORNL/TM–11907) **Worldwide advanced nuclear power reactors with passive and inherent safety: What, why, how, and who.** Forsberg, C.W.; Reich, W.J. Oak Ridge National Lab., TN (United States). Sep 1991. 103p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE92002401. Source: OSTI; NTIS; INIS; GPO Dep.

The political controversy over nuclear power, the accidents at Three Mile Island (TMI) and Chernobyl, international competition, concerns about the carbon dioxide greenhouse effect and technical breakthroughs have resulted in a segment of the nuclear industry examining power reactor concepts with PRIME safety characteristics. PRIME is an acronym for Passive safety, Resilience, Inherent safety, Malevolence resistance, and Extended time after initiation of an accident for external help. The basic ideal of PRIME is to develop power reactors in which operator error, internal sabotage, or external assault do not cause a significant release of radioactivity to the environment. Several PRIME reactor concepts are being considered. In each case, an existing, proven power reactor technology is combined with radical innovations in selected plant components and in the safety philosophy. The Process Inherent Ultimate Safety (PIUS) reactor is a modified pressurized-water reactor, the Modular High Temperature Gas-Cooled Reactor (MHTGR) is a modified gas-cooled reactor, and the Advanced CANDU Project is a modified heavy-water reactor. In addition to the reactor concepts, there is parallel work on super containments. The objective is the development of a passive "box" that can contain radioactivity in the event of any type of accident. This report briefly examines: why a segment of the nuclear power community is taking this new direction, how it differs from earlier directions, and what technical options are being considered. A more detailed description of which countries and reactor vendors have undertaken activities follows. 41 refs.

6752 **Robot arm apparatus.** Nachbar, H.D. To Dept. of Energy. 1990. Filed date 2 Jul 1990. USA Patent patent application

7-546,827. 21p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC12-76SN00052. Order Number DE92003817. Source: OSTI; NTIS; GPO Dep.

A robot arm apparatus is provided for inspecting and/or maintaining an interior of a steam generator which has an outside wall and a port for accessing the interior of the steam generator. The robot arm apparatus includes a flexible movable conduit for conveying inspection and/or maintenance apparatus from outside the steam generator to the interior of the steam generator. The flexible conduit has a terminal working end which is translated into and around the interior of the steam generator. Three motors located outside the steam generator are employed for moving the terminal working end inside the steam generator in "x," "y," and "z" directions, respectively. Commonly conducted inspection and maintenance operations include visual inspection for damaged areas, water jet lancing for cleaning sludge deposits, core boring for obtaining sludge deposits, and scrubbing of internal parts.

6753 **Nuclear qualified in-containment electrical connectors and methods of connecting electrical conductors.** Powell, J.G. To Dept. of Energy. 1990. Filed date 9 Jul 1990. USA Patent patent application 7-549,982. 12p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC12-76SN00052. Order Number DE92003820. Source: OSTI; NTIS; GPO Dep.

A nuclear qualified in-containment electrical connection comprises an insulated, sheathed instrument lead having electrical conductors extending from one end thereof to provide two exposed lead wires, a watertight cable having electrical conducting wires therein and extending from one end of the cable to provide two lead wires therefrom, two butt splice connectors each connecting the ends of respective ones of the lead wires from the instrument lead and cable, a length of heat shrinkable plastic tubing positioned over each butt splice connector and an adjacent portion of a respective lead wire from the cable and heat shrunk into position, a length of heat shrinkable plastic tubing on the end portion of the instrument lead adjacent the lead wires therefrom and heat shrunk thereon and a length of outer heat shrinkable plastic tubing extending over the end portion of the instrument lead and the heat shrinkable tubing thereon and over the butt splice connectors and a portion of the cable adjacent the cable lead lines, the outer heat shrinkable tubing being heat shrunk into sealing position on the instrument lead and cable.

6754 (SAND–91-1397C) **Aging, condition monitoring, and loss-of-coolant accident (LOCA) tests of Class 1E electrical cables: Summary of results.** Jacobus, M.J. Sandia National Labs., Albuquerque, NM (United States). [1991]. 16p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC04-76DP00789. (CONF-911079–12: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). Order Number DE92003615. Source: OSTI; NTIS; INIS; GPO Dep.

This paper summarizes the results of aging, condition monitoring, and accident testing of Class 1E cables used in nuclear power generating stations. Three sets of cables were aged for up to 9 months under simultaneous thermal (≃ 100°C) and radiation (≃0.10 kGy/hr) conditions. After the aging, the cables were exposed to a simulated accident consisting of high dose rate irradiation (≃6 kGy/hr) followed by a high temperature steam exposure. A fourth set of cables, which were unaged, were also exposed to the accident conditions. The cables that were aged for 3 months and then accident tested were subsequently exposed to a high temperature steam fragility test (up to 400°C), while the cables that were aged for 6 months and then accident tested were subsequently exposed to a 1000-hour submergence test in a chemical solution. The results of the tests indicate that the feasibility of life extension of many popular nuclear power plant cable products is promising and that mechanical measurements (primarily elongation, modulus, and density) were more effective than electrical measurements for monitoring age-related degradation. In the high temperature steam test, ethylene propylene rubber (EPR) cable materials generally survived to higher temperatures than crosslinked polyolefin (XLPO) cable materials. In dielectric testing after the submergence testing, the XLPO materials performed better than the EPR materials. This paper presents some recent experimental data that are not yet available elsewhere and a summary of findings from the entire experimental program.

6755 (SAND–91-1459C) **An approach for assessing ALWR passive safety system reliability.** Hake, T.M. Sandia National Labs., Albuquerque, NM (United States). [1991]. 17p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC04-76DP00789. (CONF-911079–15: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). Order Number DE92004013. Source: OSTI; NTIS; INIS; GPO Dep.

Many advanced light water reactor designs incorporate passive rather than active safety features for front-line accident response. A method for evaluating the reliability of these passive systems in the context of probabilistic risk assessment has been developed at Sandia National Laboratories. This method addresses both the component (e.g. valve) failure aspect of passive system failure, and uncertainties in system success criteria arising from uncertainties in the system's underlying physical processes. These processes provide the system's driving force; examples are natural circulation and gravity-induced injection. This paper describes the method, and provides some preliminary results of application of the approach to the Westinghouse AP600 design.

6756 (SAND–91-1610C) **Status of the low power and shutdown accident sequence analysis project for the Grand Gulf Nuclear Power Station.** Whitehead, D.W. (Sandia National Labs., Albuquerque, NM (United States)); Staple, B.E.; Brown, T.D.; Darby, J.; Walsh, B. Sandia National Labs., Albuquerque, NM (United States). [1991]. 14p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC04-76DP00789. (CONF-911079–11: 19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting, Bethesda, MD (United States), 28-30 Oct 1991). Order Number DE92003617. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes the current status of Phase 1 and 1A of the BWR Low Power and Shutdown Accident Frequencies Program being conducted at Sandia National Laboratories for the US Nuclear Regulatory Commission. The major focus of the project to date has been the identification and coarse screening quantification of accident sequences initiated in modes of operation other than full power. The coarse screening provides a filtering mechanism whereby the potentially important accident sequences are identified. The information obtained during these two phases will be used to prioritize the more detailed analyses which will occur during Phase 2 of this project. A summarization of the project including results and insights from Phase 1 and 1A is presented. 2 refs., 5 figs.

6757 (SAND–91-2407C) **Adiabatic equilibrium models for direct containment heating.** Pilch, M.M. Sandia National Labs., Albuquerque, NM (United States). [1991]. 16p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC04-76DP00789. (CONF-9110210–3: 1991 water reactor safety meeting, Washington, DC (United States), 28-30 Oct 1991). Order Number DE92004729. Source: OSTI; NTIS; INIS; GPO Dep.

PRA studies are being extended to include a wider spectrum of reactor plants than was considered in NUREG-1150. There is a need for computationally simple models for Direct Containment Heating (DCH) that could be used for screening studies aimed at identifying potentially significant contributors to risk. This paper discusses two adiabatic equilibrium models that are candidates for the task. The first, a 1-cell model, places a true upper bound on DCH loads. This upper bound, however, often far exceeds reasonable expectations of containment loads based on best estimate CONTAIN calculations or experiment observations. In this paper, a 2-cell model is developed that largely captures the major mitigating features of containment compartmentalization, thus providing more reasonable estimates of the containment load. Predictions of the equilibrium models are compared with experiment data from the Limited Flight Path (LFP) test series conducted at Sandia National Laboratories.

6758 (SAND–91-2461C) **Initial performance assessment of the Westinghouse AP600 containment design and related safety issues.** Tills, J.L. (Tills (Jack) and Associates, Inc., Albuquerque, NM (United States)); Washington, K.E.; Nicolette, V.F. Sandia National Labs., Albuquerque, NM (United States). [1991].

22p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC04-76DP00789. (CONF-9110210–2: 1991 water reactor safety meeting, Washington, DC (United States), 28-30 Oct 1991). Order Number DE92004743. Source: OSTI; NTIS; INIS; GPO Dep.

The CONTAIN code is currently being used to predict containment thermal hydraulic conditions during design basis and severe accidents for advanced light water reactor (ALWR) designs such as the Westinghouse AP600. In the AP600 design, a passive containment cooling system (PCCS) is used for reducing long-term overpressure during accidents. CONTAIN models for heat and mass transfer within the AP600 containment and outer air cooling channel are verified by comparing recent CONTAIN calculations to integral test data obtained by Westinghouse in their PCCS Integral Test Facility. The comparison includes test in which the outer containment wall is both dry and wet, that is, the wet tests involve an evaporative water film that enhances heat transfer as will be the case for AP600. The appropriateness of the heat and mass transfer analogy methodology used in the CONTAIN code is demonstrated. Code model limitations are discussed along with model development plans and applications for AP600.

6759 (SAND–91-2613C) **The Integral Effects Test (IET-1) in the Surtsey Test Facility.** Allen, M.D.; Griffith, R.O.; Pilch, M.M.; Nichols, R.T. Sandia National Labs., Albuquerque, NM (United States). [1991]. 25p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC04-76DP00789. (CONF-9110210–4: 1991 water reactor safety meeting, Washington, DC (United States), 28-30 Oct 1991). Order Number DE92004355. Source: OSTI; NTIS; INIS; GPO Dep.

The first experiment of the Integral Effects Test (IET-1) series was conducted to investigate the effects of high pressure melt ejection (HPME) on direct containment heating (DCH). A 1:10 linear scale model of the Zion reactor pressure vessel (RPV), cavity, instrument tunnel, and subcompartment structures were constructed in the Surtsey Test Facility at Sandia National Laboratories (SNL). The RPV was modelled with a melt generator that consisted of a steel pressure barrier, a cast MgO crucible, and a thin steel inner liner. The melt generator/crucible had a semi-hemispherical bottom head containing a graphite limitor plate with a 3.5 cm exit hole to simulate the ablated hole in the RPV bottom head that would be formed by tube ejection in a severe nuclear power plant (NPP) accident. The reactor cavity model contained 3.48 kg of water with a depth of 0.9 cm that corresponded to condensate levels in the Zion plant. A steam driven iron oxide/aluminum/chromium thermite was used to simulate HPME. A relatively small steam explosion occurred in the cavity during IET-1. Steam blowthrough entrained debris into the Surtsey vessel resulting in a peak pressure increase in Surtsey of 98 kPa. The Surtsey vessel had been previously inerted with N_2. The total debris mass ejected into the Surtsey vessel was 43 kg. The hydrogen concentration was 3.1 mol.% in the vessel at equilibrium. The concentration measured inside the subcompartment structures immediately following HPME transient was 20.7 mol.% H_2. 4 refs., 17 figs., 5 tabs.

6760 (UNI–785) **N Reactor ACRS briefing report, 1968–1976.** United Nuclear Industries, Inc., Richland, WA (United States). Jun 1977. 120p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-87RL10930. Order Number DE92001748. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This ACRS Briefing Report is intended to appraise the Advisory Committee on Reactor Safeguards of items pertaining to the safety of the Hanford N Reactor. The first portion of the report briefly describes the reactor and its engineered safety systems. The balance of the report describes the significant plant modifications and operating experiences important to safety since the last ACRS Report in 1968. The starting date for this report was selected as the date of the last ACRS Report to assure adequate overlap and continuity of information. Later meetings to discuss specific topics related to N Reactor operation were held with the ACRS Hanford Subcommittee in August 1970. The portion of the report pertinent to safety of operations covers the Status of the Effluent Control Program, Plant Modifications Since the Effluent Control Program, Recent Regulatory Activities, and Operating Experiences Pertinent to Nuclear Safety. 23 refs., 12 figs., 3 tabs.

24 POWER TRANSMISSION AND DISTRIBUTION

2402 Power System Networks, Transmission and Distribution

6761 (CONF-920223–2) **MHD-EMP interaction with power transmission and distribution systems.** Tesche, F.M. (Tesche (F.M.), Dallas, TX (United States)); Barnes, P.R. Oak Ridge National Lab., TN (United States). [1991]. 6p. Sponsored by U.S. DOE Conservation & Renewable Energy; U.S. Department of Defense. DOE Contract AC05-84OR21400. From 1992 hardened electronics and radiation technology (HEART) conference; Albuquerque, NM (United States); 24-28 Feb 1992. Order Number DE92003541. Source: OSTI; NTIS; GPO Dep.

A nuclear detonation at altitudes of several hundred kilometers above the earth will distort the earth's magnetic field and results in a time-variation of the geomagnetic field on the earth's surface. This magnetic field interacts with the finitely conducting earth to produce a time varying electric field, also on the earth's surface. Known at the magnetohydrodynamic electromagnetic pulse (MHD-EMP), this resulting E-field can induce a net voltage in long electrical conductors, such as power transmission lines. If these conductors are electrically connected to the earth at both ends, a current can be induced to flow in the conductors, and this can cause damage or upset to certain electrical systems. This paper presents the results of a study on the interaction of the MHD-EMP with power transmission and distribution (T&D) systems. A brief overview of the MHD-EMP environment used in the study is presented, and the analytical models used for estimating the coupling of this environment to T&D lines are discussed. Because of the quasi-static nature of MHD-EMP, the models are essentially simple DC circuit models. However, complications arise in attempting to treat realistic line configurations having a large number of support towers and an overhead shield or neutral wires. There models are discussed in detail. 3 refs., 5 figs., 1 tab.

6762 **Wedge assembly for electrical transformer component spacing.** Baggett, F.E.; Cage, W.F. To Dept. of Energy. 1990. Filed date 4 Jun 1991. USA Patent patent application 7-532,545. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE92003742. Source: OSTI; NTIS; GPO Dep.

This invention is comprised of a wedge assembly that is easily inserted between two surface to be supported thereby, and thereafter expanded to produce a selected spacing between those surfaces. This wedge assembly has two outer members that are substantially identical except that they are mirror images of each other. Oppositely directed faces of these of these outer members are substantially parallel for the purpose of contacting the surfaces to be separated. The other faces of these outer members that are directed toward each other are tapered so as to contact a center member having complementary tapers on both faces. A washer member is provided to contact a common end of the outer members, and a bolt member penetrates this washer and is threadably received in a receptor of the center member. As the bolt member is threaded into the center member, the center member is drawn further into the gap between the outer members and thereby separates these outer members to contact the surfaces to be separated. In the preferred embodiment, the contacting surfaces of the outer member and the center member are provided with guide elements. The wedge assembly is described for use in separating the secondary windings from the laminations of an electrical power transformer.

2403 Power Transmission Lines and Cables

6763 (BNL–46823) **Ac losses in $YBa_2Cu_3O_7$ and $Bi_2Sr_2Ca_2Cl_3O_{10}$ superconductors at power frequencies.** Orehotsky, J. (Brookhaven National Lab., Upton, NY (United States)); Reilly, K.M.; Suenaga, M.; Hikata, T.; Ueyama, M.; Sato, K. Brookhaven National Lab., Upton, NY (United States). [1991]. 4p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-76CH00016. (CONF-911096–5: 4. international symposium on superconductivity, Tokyo (Japan), 14-17 Oct 1991). Order Number DE92004990. Source: OSTI; NTIS; GPO Dep.

Ac losses of sintered and melt-textured $YBa_2Cu_3O_7$ bars and powder-in-a-tube processed $Bi_2Sr_2Ca_2Cu_3O_{10}$ tapes were measured at 4.2, 65, 70 and 77 K and at 15–180 Hz. In general, the results are well described by the critical state model for the ac losses. However, the losses for the $Bi_2Sr_2Ca_2Cu_3O_{10}$ tapes at 4.2 K exhibited significant contributions from the eddy currents in the Ag sheath.

6764 (CONF-920202–2) **The effects of nonstandard lightning voltage waveshapes on the impulse strength of air gaps.** Chowdhuri, P. (Tennessee Technological Univ., Cookeville, TN (United States)); Mishra, A.K.; Martin, P.M.; McConnell, B.W. Oak Ridge National Lab., TN (United States). [1991]. 7p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From IEEE Power Engineering Society (PES) winter meeting; New York, NY (United States); 2-6 Feb 1992. Order Number DE92003530. Source: OSTI; NTIS; GPO Dep.

Sphere-sphere, rod-rod and rod-plane air gaps, each 5-cm long, were tested with lightning surges of eight voltage waveshapes of both polarities. The critical breakdown voltage of the tested air gaps showed a minima at a certain voltage wavefront. Long time delays of breakdown for the fast-front and short time delays for the slow-front waves were observed. These phenomena would significantly affect the insulation coordination of the power apparatus and system. 32 refs.

6765 **Lightning protection device for electrical lines.** Gazzola, C.; Gauchon, J.; Marichy, G. To Ferraz (France). 26 Aug 1991. Filed date 26 Feb 1990. Canada Patent patent application 2010951. 9p. (In French). Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $4.00 CAN; MF $2.75 CAN.

A lightning protection device for electrical lines, particularly medium-voltage overhead lines, is disclosed. The device is intended to overcome the disadvantages of currently known devices, such as susceptibility to attack by pollutants and damage during installation. According to the invention, the rigid tube which normally encloses the insulating element of such devices is cut by at least one port, while the enclosure is directly formed by molding upon the insulating element such that the synthetic resin used to form the enclosure penetrates to the inside of the tube and coats the stack of resistance elements which make up, along with the connector capsules, the insulating element. With a view to reinforcing the watertightness of the assembly, the extremities of the exterior enclosure made of molded resin are profiled to present a lip of circular profile which is oriented axially towards the exterior so as to engage a corresponding annular seating provided in each one of two metallic instrument forming contacts for the mounting of the lightning protection device. 6 figs.

2404 Health and Safety

Refer also to citation(s) 6761

25 ENERGY STORAGE

2501 Magnetic

6766 (ORNL/HTSPC–1) **Survey of domestic research on superconducting magnetic energy storage.** Dresner, L. Oak Ridge National Lab., TN (United States). Sep 1991. 31p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE92004108. Source: OSTI; NTIS; INIS; GPO Dep.

This report documents the results of a survey of domestic research on superconducting magnetic energy storage (SMES) undertaken with the support of the Oak Ridge National Laboratory (ORNL) Superconductivity Pilot Center. Each survey entry includes the following: Name, address, and other telephone and facsimile numbers of the principal investigator and other staff members; funding for fiscal year 1991, 1992, 1993; brief descriptions of the program, the technical progress to date, and the expected technical progress; a note on any other collaboration. Included with the survey are recommendations intended to help DOE decide how best to support SMES research and development (R&D). To summarize, I would say that important elements of a well-rounded SMES research program for DOE are as follows. (1) Construction of a large ETM. (2) Development of SMES as an enabling technology for solar and wind generation, especially in conjunction with the ETM program, if possible. (3) Development of small SMES units for electric networks, for rapid transit, and as noninterruptible power supplies [uses (2), (3), and (4) above]. In this connection, lightweight, fiber-reinforced polymer structures, which would be especially advantageous for space and transportation applications, should be developed. (4) Continued study of the potential impacts of high-temperature superconductors on SMES, with construction as soon as feasible of small SMES units using high-temperature superconductors (HTSs).

2509 Batteries

6767 (EGG-EP–9766) **Battery availability for near-term (1998) electric vehicles.** Burke, A.F. EG and G Idaho, Inc., Idaho Falls, ID (United States). Jun 1991. 48p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC07-76ID01570. Order Number DE92003331. Source: OSTI; NTIS; GPO Dep.

Battery Requirements were determined for a wide spectrum of electric vehicles ranging from 2-passenger sports cars and microvans to full-size vans with a payload of 500 kg. All the vehicles utilize ac, high voltage (340–360 V) powertrains and have acceleration performance (0–80 km/h in less than 15 seconds) expected to be the norm in 1988 electric vehicles. Battery packs were configured for each of the vehicles using families of sealed lead-acid and nickel-cadmium modules which are either presently available in limited quantities or are being developed by battery companies which market a similar battery technology. It was found that the battery families available encompass the Ah cell sizes required for the various vehicles and that they could be packaged in the space available in each vehicle. The acceleration performance and range of the vehicles were calculated using the SIMPLEV simulation program. The results showed that all the vehicles had the required acceleration characteristics and ranges between 80–160 km (50–100 miles) with the ranges using nickel-cadmium batteries being 40–60% greater than those using lead-acid batteries. Significant changes in the design of electric vehicles over the last fifteen years are noted. These changes make the design of the batteries more difficult by increasing the peak power density required from about 60 W/kg to 100–150 W/kg and by reducing the Ah cell size needed from about 150 Ah to 30–70 Ah. Both of these changes in battery specifications increase the difficulty of achieving low $/kWh cost and long cycle life. This true for both lead-acid and nickel-cadmium batteries. 25 refs., 6 figs., 16 tabs.

6768 (SAND–91-2529C) **Accelerated testing of batteries.** Levy, S.C. (Sandia National Labs., Albuquerque, NM (United States)); Bro, P. Sandia National Labs., Albuquerque, NM (United States). [1992]. 8p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-920151–1: 7. annual battery conference on applications, Long Beach, CA (United States), 21-23 Jan 1992). Order Number DE92004739. Source: OSTI; NTIS; GPO Dep.

Three methods of evaluating accelerated battery test data are described. Criteria for each method are used to determine the minimum test matrix required for accurate predictions. Other test methods involving high current discharge and real time techniques are discussed.

6769 (SAND–91-2694) **Utility Battery Exploratory Technology Development Program report for FY91.** Magnani, N.J.; Butler, P.C.; Akhil, A.A.; Braithwaite, J.W.; Clark, N.H.; Freese, J.M. Sandia National Labs., Albuquerque, NM (United States). Dec 1991. 117p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789. Order Number DE92004854. Source: OSTI; NTIS; GPO Dep.

Sandia National Laboratories, Albuquerque, manages the Utility Battery Exploratory Technology Development Program, which is sponsored by the US Department of Energy's Office of Energy Management. In this capacity, Sandia is responsible for the engineering analyses and development of rechargeable batteries for utility-energy-storage applications. This report details the technical achievements realized during fiscal year 1991. Sodium/Sulfur, Zinc/Bromine, Nickel/Hydrogen, Aluminium/Air and Lead/Acid batteries are evaluated.

6770 (TKK-KO/LTK-44) **Manufacture of air electrodes and long run tests.** Lamminen, J. (Helsinki Univ. of Technology, Otaniemi (Finland). Lab. of Thermal Engineering); Lampinen, M.J.; Viitanen, M.; Vuorisalo, J.; Kivisaari, J. Helsinki Univ. of Technology, Otaniemi (Finland). Lab. of Thermal Engineering. 1990. 11p. Order Number DE92728394. Source: OSTI; NTIS (US Sales Only).

NEMO Research Programme- Also available as PB-90-255126/XAB.

In this study some alternative catalysts for oxygen reduction in an alkaline electrolyte (7 M KOH) were tested. The catalysts tested were: CoTMPP, $LaNiO_3$, Pt (for comparison) and MnO_2. The electrodes were manufactured by the rolling method. The best electrodes made in this way has been tested in a long run test, testing times ranging from 425 hours to 660 hours. The decay in potential during the 660 hour run was 0.041 mV/h.

6771 **Universal electrolyte level indicator for wet cell batteries.** Dattilo, D.P. 22 Aug 1991. Filed date 22 Feb 1990. Canada Patent patent application 2010707. 28p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $4.00 CAN; MF $2.75 CAN.

An electrolyte level indicator is provided which may be attached to, and made part of, battery-powered mobile equipment of all types for the purposes of giving a warning indication to the operator of the equipment that water needs to be added to the batteries. The monitor of the invention includes a battery cap sensor probe that is inserted into a single cell of a wet-cell battery and electrically connected, through a single wire, to a panel-mounted transducer that indicates, by means of a flashing light-emitting diode, that the electrode is below an acceptable level, thereby producing a general indication that all the cells in the battery or batteries should be filled with water. 6 figs.

6772 **Manganese dioxide cathode for a rechargeable alkaline cell, and cell containing the same.** Tomantschger, K.; Michalowski, C.S. 15 Aug 1991. Filed date 15 Feb 1990. Canada Patent patent application 2010142. 36p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $4.00 CAN; MF $2.75 CAN.

In rechargeable manganese dioxide cells, usually alkaline cells with zinc anodes or cells having non-aqueous electrolyte and lithium anodes, the cathodes are essentially unconstrained; no cage is used in the cell between the cathodes and the anodes. The cathode is restricted from significantly changing its dimensions during discharge of the cell, when it is inclined to swell, as opposed to the tendency of the cathode to contract during a charge cycle. The cathode substantially fills the entire space alloted for it within the cell, with a slight accommodation for height-wise or longitudinal expansion or growth of the cathode of bobbin-type cells, or cross-wise expansion or growth of button-type cells. There may be additives in the cathode mix, including particularly conductive fibers of graphite or other conductive materials, and other materials including metallic additives. Methods of manufacture of the cathode include compaction and recompaction of the cathode pellet; a range of compaction pressures is suggested. Cells according to the invention are capable of exhibiting high current drain rates and long cycle life. Experiments are described to illustrate the invention. 2 figs.

29 ENERGY PLANNING AND POLICY

2902 Economics and Sociology

Refer also to citation(s) 6309

6773 (AFME-90-12-Doc) **Energy expenses: 1986-1989.** Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France). 1990. 47p. (In French). Order Number DE92743182. Source: OSTI; NTIS (US Sales Only).

Tables and diagrams of the different energies prices are presented for the period 1986-1989 in France. The energy overall bill is 83 billions FF in 1989, that is a 25 pc increase referred to 1988. Oil price has increased by 30pc; for the end-user, the increases were 20 pc for heavy gas oil, + 10 pc for domestic fuel oil, + 6 pc for motor fuel and propane. Coal price decreased by 5 pc, wood by 15 pc. Gas and electricity encountered lower variations (from -0.5 pc to + 1.5 pc).

6774 (CONF-9111144-2) **Gender differences: Let's see them in writing.** Boser, J.A. (Tennessee Univ., Knoxville, TN (United States)); Wiley, P.D.; Clark, S.B. Tennessee Univ., Knoxville, TN (United States); Oak Ridge Associated Universities, Inc., TN (United States). [1991]. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-76OR00033. From Annual meeting of the Mid-South Educational Research Association; Lexington, KY (United States); 13-15 Nov 1991. Order Number DE92004762. Source: OSTI; NTIS; GPO Dep.

Differences between males and females in the nature of their verbal communication have been documented. The findings of this study have provided a new dimensional to those of previous research. There is support for the idea that among college graduates with similar communication skills, females use written communication as a means of establishing rapport more than males. In a voluntary, relatively unstructured task, females tend to write longer responses and to express themselves by complete thoughts (sentences). Females are also more likely to use first person singular pronouns and first person singular possessive adjectives. There is no support in this situation for gender differences in offering solutions to described program weaknesses. The length of the open-ended responses describing weaknesses and strengths are more closely related to each other than they are to ratings of program satisfaction. This study was unique in that it was based on written communication of college graduates in a voluntary task. Differences in findings from of those of other studies may be due to experience and education of the participants. 7 refs., 2 tabs.

6775 (DOE/MI/10150-T1) **Factors affecting retention in science-based curriculums at HBCUs.** Pelham, J. Pennsylvania Univ., Philadelphia, PA (United States). [1991]. 56p. Sponsored by U.S. DOE Office of Minority Economic Impact. DOE Contract FG03-89MI10150. Order Number DE92005260. Source: OSTI; NTIS; GPO Dep.

A systematic and comprehensive study of the retention of minority students enrolled in college-level engineering was conducted. The majority of prior work in this area focused on institutional retention factors for students in non-specified majors and considered students "dropouts" whenever there was a break in enrollment. This study looked only at students whose beginning major was engineering, enrolled primarily at historically black colleges and universities (HBCUs), including a comparison sample from a predominantly white institution (PWI). Science persisters were defined as those students who continuously enrolled in post-secondary institutions full- and part-time – whether or not they transferred between institutions. The critical factor was their continued enrollment in engineering. Study participants provided four types of information: (1) a measure of academic motivation, (2) an objective measure of science interest, (3) a measure of nine aspects of normal personality functioning, and (4) an assessment of selected demographic variables. 64 refs.

6776 (DOE/NV/10384-65) **Archaeological data recovery at drill pad U19AX Nye County, Nevada: Technical report No. 65.** Henton, G.H.; Pippin, L.C. Nevada Univ., Las Vegas, NV (United States). Desert Research Inst. Dec 1991. 90p. Sponsored by U.S.

DOE Defense Programs. DOE Contract AC08-85NV10384. Order Number DE92004831. Source: OSTI; NTIS; GPO Dep.

At the Nevada Test Site, in the early spring of 1988, the Quaternary Sciences Center of the Desert Research Institute (DRI) conducted investigations at three archaeological sites near event site U19ax. These sites, recorded earlier during an archaeological reconnaissance of the event site as part of the environmental compliance activities, were determined eligible for the National Register of Historic Places (NRHP) and were in danger of being adversely impacted by construction activities or the effects of the underground test. The DRI proposed a plan of investigations which included controlled surface collections and excavations and, after concurrence of the Nevada Division of Historic Preservation and Archaeology (NDHPA) and the Advisory Council of Historic Preservation (ACHP), conducted the data recovery. The artifacts recovered from the surface scatter imply a long-duration, but low-intensity, use of the region for relatively general functions. The sites are interpreted as small temporary camps which overlay each other. The rockshelter appears to be a small temporary camp which was occupied twice, once historically, and once about 2,800 years ago. While these investigations mitigate most of the adverse impacts from the event at U19ax, significant archaeological sites still exist in the general vicinity and should further tests be conducted in the region, additional investigations may be warranted.

6777 (DOE/NV/10384–T1) **NTS American Indian Religious Freedom Act Compliance Program complying with AIRFA: A literature review and evaluation.** Pippin, L.C. Nevada Univ., Reno, NV (United States). Desert Research Inst. Sep 1991. 160p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC08-85NV10384. Order Number DE92004243. Source: OSTI; NTIS; GPO Dep.

The First Amendment to the United States Constitution guarantees the inherent right of all Americans to freedom of religion. However, since the religious practices of Native Americans are significantly different from those of the majority of Americans, their religious freedom has often restricted. Section 2 of the American Indian Religious Freedom Act (AIRFA) of 1978 (Public Law 95-341) directs federal agencies to consult with Native Americans to determine appropriate procedures to protect the inherent rights of Native Americans to believe, express, and exercise their traditional religions including, but not limited to access to sites, use and possession of sacred objects, and freedom to worship through ceremonials and traditional rites. The NTS AIRFA Compliance Program was initiated in October 1989 to assist DOE in expanding its compliance with AIRFA to incorporate all weapons testing activities on the NTS. It is directed at the development and implementation of a consultation plan designed to solicit, on behalf of DOE, Native American comments regarding the effects of the DOE's nuclear testing activities on historic properties of Native American origin and the expression and exercise of traditional Native American religions. The program has been developed around a phased approach that includes; (1) literature review and evaluation, (2) preparation of a baseline document, (3) preparation of a study design, (4) consultation with Native Americans, (5) preparation of a draft report, (6) Native American and State consultation and review, and (7) preparation of a final report.

6778 (DOE/NV/10845–66) **Inter and intrasite analyses of cultural materials from U20aw, Nye County, Nevada: Technical report No. 66.** Hicks, P.A.; Pippin, L.C.; Henton, G.H. Nevada Univ., Las Vegas, NV (United States). Desert Research Inst. Dec 1991. 186p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC08-90NV10845. Order Number DE92004832. Source: OSTI; NTIS; GPO Dep.

This archaeological presents the results of the analyses of the data derived from all sites investigated during the data recovery operations on Drill Hole U20aw on the Nevada Test Site, Nye County Nevada. These sites were determined to be potentially eligible for inclusion in the national Register of Historic Places. Detailed analyses were focused on the spatial distribution of artifacts and features within and between sites in the southern portion of the study area. These analyses indicate that one area served principally as a temporary camp, while the area around the canyonhead to the east seems to have been used as a site for both temporary camps and special activity loci. Projectile point styles suggest that the area was occupied from the Early Archaic into the early Historic period. Analyses of the artifacts that were recovered indicate that obsidian was the preferred material for all classes of flaked stone tools. All stages of lithic reduction are represented on the sites, but core reduction and thinning of bifaces appear to have been the primary activities. Processing of floral foods is indicated by the presence of several ground stone artifacts. Pinyon nuts and other items appear to have been stored in several areas as evidenced by the presence of several rock features that may have served as caches.

2903 Environment, Health, and Safety

Refer also to citation(s) 6231, 6233, 6462, 6593, 6792, 6794, 6802, 6806, 7104, 7576, 7614, 7806, 7818, 8447

6779 (CONF-9110291–1) **Oak Ridge National Laboratory's philosophy and approach to NEPA.** Van Hook, R.I.; Braunstein, H.M.; Sigal, L.L.; Trettin, C.C. Oak Ridge National Lab., TN (United States). [1991]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Federal Construction Council symposium on dealing with environmental concerns in the comprehensive; Washington, DC (United States); 31 Oct 1991. Order Number DE92002810. Source: OSTI; NTIS; INIS; GPO Dep.

At Oak Ridge National Laboratory (ORNL), the overall responsibility for compliance with the National Environmental Policy Act (NEPA) resides with Environmental Review and Documentations Section that is within the Office of Environmental Compliance and Documentation (OECD). Organizationally, OECD is a line-management division reporting to the Director for Environmental, Safety and Health Compliance. The cornerstone for NEPA compliance at ORNL is the Internal Environmental Assessment (IEA), which is designed to provide a basis for NEPA review and documentation. The Standard Operating Procedures provide for evaluation and documentation records management and training, and auditing. The IEA provides a project description and a review of environmental, health and safety issues. The completed IEA is used to make recommendations to DOE regarding the appropriate level of NEPA documentation required for the action. NEPA documents which may be prepared include the Categorical Exclusion, Abbreviated Environmental Assessment, and Environmental Assessment; actions requiring Environmental Impact Statements are prepared by US Department of Energy (US DOE). The relatively recent DOE initiative for agency-wide compliance with NEPA has created areas in which ORNL has found itself lacking adequate resources and expertise. These are discussed in this paper. Throughout ORNL, there is strong management support for compliance with NEPA which has resulted in enhanced awareness and implementation of the NEPA requirements. Guidance is being provided and Laboratory divisions are factoring early integration of NEPA into their project planning with the goal of ensuring that their activities are carried out in full compliance with the letter and the spirit of NEPA and the other environmental statutes and regulations.

6780 (DOE/EH–0219) **Glossary of CERCLA-related terms and acronyms.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). RCRA/CERCLA Div. Oct 1991. 104p. Sponsored by U.S. DOE Environment Safety & Health. Source: OSTI (Free of Charge); INIS.

This glossary contains CERCLA-related terms that are most often encountered in the US Department of Energy (DOE) Environmental Restoration and Emergency Preparedness activities. Detailed definitions are included for key terms. The definitions included in this glossary are taken from the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended, related federal rulemakings (e.g., 40 CFR 300, National Oil and Hazardous Substances Pollution Contingency Plan), assorted guidance documents prepared by the US Environmental Protection Agency (EPA), and DOE Order 5400.4. The source of each term is noted after the term. Terms presented in this document reflect revised and new definitions published before June 1, 1991. 20 refs.

6781 (DOE/EH–0220) **Federal environmental inspections handbook.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). RCRA/CERCLA Div. Oct 1991. 195p. Sponsored by U.S. DOE Environment Safety & Health. Source: OSTI (Free of Charge); INIS.

This Federal Environmental Inspection Handbook has been prepared by the Department of Energy (DOE), Office of Environmental Guidance, RCRA/CERCLA Division (EH-231). It is designed to provide DOE personnel with an easily accessible compilation of the environmental inspection requirements under Federal environmental statutes which may impact DOE operations and activities. DOE personnel are reminded that this Handbook is intended to be used in concert with, and not as a substitute for, the Code of Federal Regulations (CFR). Federal Register (FR), and other applicable regulatory documents.

6782 (DOE/EH–0227P) **OSHA training requirements for hazardous waste operations.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). Dec 1991. 30p. Sponsored by U.S. DOE Environment Safety & Health. Order Number DE92004780. Source: OSTI; NTIS; GPO Dep.

This guidance addresses training requirements for personnel working, auditing, touring, and visiting DOE hazardous waste areas, including treatment, storage and disposal (TSD) facilities regulated under the Resource Conservation and Recovery Act (RCRA), and environmental restoration sites regulated under RCRA corrective action authority and/or the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Applicable DOE Orders and the OSHA regulations should be consulted to ensure full compliance with all requirements.

6783 (EGG–10617-2093) **Environmental protection and regulatory compliance at the Elk Hills Field.** Chappelle, H.H. (BCM Engineers, Inc., Plymouth Meeting, PA (United States)); Donahoe, R.L.; Kato, T.T.; Ordway, H.E. EG and G Energy Measurements, Inc., Las Vegas, NV (United States). [1991]. 13p. Sponsored by U.S. DOE Environment Safety & Health. DOE Contract AC08-88NV10617. (SPE–22816;CONF-9110149–4: 66. annual Society of Petroleum Engineers (SPE) technical conference and exhibition, Dallas, TX (United States), 6-9 Oct 1991). Order Number DE92004366. Source: OSTI; NTIS; GPO Dep.

Environmental protection has played an integral role in the development and operation of the Elk Hills field since production at the maximum efficient rate was authorized in 1976. The field is located in a non-attainment area for California and National Ambient Air Quality Standards for two criteria pollutants and their associated precursors, is home to four endangered species, and operates within the California regulatory framework. Environmental protection and regulatory compliance is a multi-faceted program carried out through a substantial commitment of resources and workforce involvement. This paper describes the actions taken and resources employed to protect the environment, specific technologies and projects implement, and the ongoing nature of these efforts at Elk Hills.

6784 (ES/ER/TM–19) **Environmental Restoration Program Management Control Plan.** Oak Ridge National Lab., TN (United States). Sep 1991. 33p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC05-84OR21400. Order Number DE92003747. Source: OSTI; NTIS; INIS; GPO Dep.

This Management Control Plan has been prepared to define the Energy Systems approach to managing its participation in the US DOE's Environmental Restoration (ER) Program in a manner consistent with DOE/ORO 931: Management Plan for the DOE Field Office, Oak Ridge, Decontamination and Decommissioning Program; and the Energy Systems Environmental Restoration Contract Management Plan (CMP). This plan discusses the systems, procedures, methodology, and controls to be used by the program management team to attain these objectives.

6785 (IC–90/239) **The greenhouse effect.** Choudhury, A.M. International Centre for Theoretical Physics, Trieste (Italy). Oct 1990. 14p. Order Number DE92613622. Source: OSTI; NTIS (US Sales Only); INIS.

In this paper, the effect of the increase of the temperature of the earth's atmosphere as a consequence of the increase in the CO_2 and other trace gas content has been reviewed. The results of various model studies have been included. There is the frightening prediction that global mean temperature will rise by several degrees with the consequent rise of mean sea level. Model computations also show that in the tropics rainfall will increase whereas in the subtropics and southern mid latitude, rainfall will decrease. If this happens, mankind will be faced with a major disaster in history. Agreement between theory and observations has been discussed. (author). 16 refs, 8 tabs.

6786 (INIS-mf–13043) **Climatic and other global effects of nuclear war: Summary of a United Nations study.** Disarmament facts. United Nations, New York, NY (USA). Dept. for Disarmament Affairs. Jan 1989 15p. Order Number DE92613623. Source: OSTI; NTIS (US Sales Only); INIS.

Published in the official languages of the United Nations.

A major nuclear war would entail the high risk of disruption to the global environment, and the risk would be greatest if large cities and industrial centres in the northern hemisphere were to be targeted in the summer months. The report of the UN Study Group confirms that a nuclear war could not be won and must not be fought, and thus makes a strong argument for the pursuit of sharp reductions in, and the ultimate eradication of, nuclear weapons.

6787 (Juel–2495) **The verification of international conventions on protection of the environment and common resources. A comparative analysis of the instruments and procedures for international verification with the example of thirteen conventions.** Fischer, W. Forschungszentrum Juelich GmbH (Germany). Programmgruppe Technologiefolgenforschung. Jul 1991. 38p. Order Number DE92759274. Source: OSTI; NTIS (US Sales Only).

The results of the analysis are the following: Rules on the compliance examination by the conventions member states are laid down in the 13 conventions examined. However, they are generally imprecise and not wide ranging. The member states are indeed obliged to make declarations. The verification process is usually formulated in a very general manner: verification of national implementation reports is only explicitly envisaged in six conventions. Several explanations can be put forward for such weak verification provisions in environmental and resource protection conventions. One goes that international environmental policy either does not objectively affect any political field relevant to (inter)national security and power politics or else is not perceived as a security policy. Therefore there is at best little need for verification. Nevertheless, there are some strong arguments pointing to a gradual development in the interlinkage of security and the environment. Above all the discussion an a convention to reduce anthropogenic greenhouse gas emissions up to 60% seems to be moving in this direction. (orig./HSCH).

6788 (ORNL–6658/R9) **Environmental Regulatory Update Table, October 1991.** Houlberg, L.M.; Hawkins, G.T.; Salk, M.S. Oak Ridge National Lab., TN (United States). Nov 1991. 133p. Sponsored by U.S. DOE Environment Safety & Health. DOE Contract AC05-84OR21400. Order Number DE92004590. Source: OSTI; NTIS; GPO Dep.

Environmental Sciences Division Publication No. 3643.

The Environmental Regulatory Update Table provides information on regulatory initiatives of interest to DOE operations and contractor staff with environmental management responsibilities. The table is updated each month with information from the Federal Register and other sources, including direct contact with regulatory agencies. Each table entry provides a chronological record of the rulemaking process for that initiative with an abstract and a projection of further action.

6789 (ORNL–6658/R10) **Environmental Regulatory Update Table, November 1991.** Houlberg, L.M.; Hawkins, G.T.; Salk, M.S. Oak Ridge National Lab., TN (United States). Dec 1991. 138p. Sponsored by U.S. DOE Environment Safety & Health. DOE Contract AC05-84OR21400. Order Number DE92004594. Source: OSTI; NTIS; GPO Dep.

Environmental Sciences Division Publication No. 3643.

The Environmental Regulatory Update Table provides information on regulatory initiatives of interest to DOE operations and contractor staff with environmental management responsibilities. The table is updated each month with information from the Federal Register and other sources, including direct contact with regulatory agencies. Each table entry provides a chronological record of the rulemaking process for that initiative with an abstract and a projection of further action.

6790 (ORNL–6697) **Work plan, health and safety plan, and quality assurance project plan for hazardous waste removal at the CTF K-1654B underground collection tank.** Panter, M.S.; Burman, S.N.; Landguth, D.C.; Uziel, M.S. Oak Ridge National Lab., TN (United States). Oct 1991. 61p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC05-84OR21400. Order Number DE92004587. Source: OSTI; NTIS; GPO Dep.

The Central Training Facility (CTF), located on Bear Creek Road approximately two miles south of the K-25 Site, is utilized for training security personnel at Martin Marietta Energy Systems, Inc., Oak Ridge, Tennessee. At the request of the CTF staff, this plan has been developed for the removal of the waste contents in the facility's 500-gal septic tank and associated distribution box. The septic tank and distribution box were historically located beneath the K-1654B trailer and adjacent to the K-1654A Indoor Firing Range. Recently, however, the K-1654B trailer was removed to accommodate the objectives of this work plan as well as future construction activities planned at CTF. The purpose of this plan is to develop and assign responsibilities, establish personnel protection requirements and mandatory safety procedures, and provide for contingencies that may arise while operations are being conducted by ORNL/MAD at the CTF K-1654B underground collection tank site. This document addresses requirements of 29 CFR 1910.120, Final Rule, with respect to aspects of health and safety applicable to an underground collection tank waste removal.

6791 (PNL-SA–19675) **Environmental materials and interfaces: Proceedings.** Pacific Northwest Lab., Richland, WA (United States). Nov 1991. 53p. Sponsored by U.S. DOE Energy Research. DOE Contract AC06-76RL01830. (CONF-9009424–: Workshop on molecular science research center: environmental materials and interfaces, Richland, WA (United States), 10-12 Sep 1990). Order Number DE92004703. Source: OSTI; NTIS; INIS; GPO Dep.

A workshop that explored materials and interfaces research needs relevant to national environmental concerns was conducted at Pacific Northwest Laboratory. The purposes of the workshop were to refine the scientific research directions being planned for the Materials and Interface Program in the Molecular Science Research Center (MSRC) and further define the research and user equipment to the included as part of the proposed Environmental and Molecular Science Laboratory (EMSL). Three plenary information sessions served to outline the background, objectives, and status of the MSRC and EMSL initiatives; selected specific areas with environmentally related materials; and the status of capabilities and facilities planned for the EMSL. Attention was directed to four areas where materials and interface science can have a significant impact on prevention and remediation of environmental problems: in situ detection and characterization of hazardous wastes (sensors), minimization of hazardous waste (separation membranes, ion exchange materials, catalysts), waste containment (encapsulation and barrier materials), and fundamental understanding of contaminant transport mechanisms. During all other sessions, the participants were divided into three working groups for detailed discussion and the preparation of a written report. The working groups focused on the areas of interface structure and chemistry, materials and interface stability, and materials synthesis. These recommendations and suggestions for needed research will be useful for other researchers in proposing projects and for suggesting collaborative work with MSRC researchers. 1 fig.

2904 Energy Resources

Refer also to citation(s) 6787, 6825

2905 Research, Development, Demonstration, and Commercialization

Refer also to citation(s) 6284, 6507, 6607, 6803, 6806, 6859

6792 (CONF-910571–, pp. 422-430) **Overview of Gas Research Institute environmental research programs.** Evans, J.M. (Gas Research Inst., Chicago, IL (United States)). North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. [1991]. From 16. biennal low-rank fuels symposium; Billings, MT (United States); 20-23 May 1991. In *Proceedings of the sixteenth biennial low-rank fuels symposium.* 535p. Order Number DE92002606. Source: OSTI; NTIS; INIS.

The Gas Research Institute (GRI) is a private not-for-profit membership organization of natural gas pipelines, distribution companies and natural gas producers. GRI's purpose is to plan, to manage and to develop financing for a gas-related research and development (R and D) program on behalf of its members and their customers. GRI does not do any research itself. GRI's R and D program is designed to provide advanced technologies for natural gas supply, transport, storage, distribution and end-use applications in all markets. In addition, basic research is conducted for GRI in these areas to build a foundation for future technology breakthroughs. Work in the Environment and Safety Research Department includes sections interested in: supply related research, air quality research, end use equipment safety research, gas operations safety research, and gas operations environmental research. The Natural Gas Supply Program has research ongoing in such areas as: restoration of pipeline right-of-ways; cleaning up town gas manufacturing sites; the development of methanogenic bacteria for soil and groundwater cleanup; development of biological fluidized carbon units for rapid destruction of carbonaceous compounds; research on liquid redox sulfur recovery for sulfur removal from natural gas; research on produced water and production wastes generated by the natural gas industry; environmental effects of coalbed methane production; and subsurface effects of natural gas operations. The western coalbed methane and ground water programs are described.

6793 (EGG-M–91482) **Technology transfer from the space exploration initiative.** Buden, D. EG and G Idaho, Inc., Idaho Falls, ID (United States). 14 Jun 1991. 7p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-920104–21: 9. symposium on space nuclear power systems, Albuquerque, NM (United States), 13-16 Jan 1992). Order Number DE92003317. Source: OSTI; NTIS; INIS; GPO Dep.

Space exploration has demonstrated that it stimulates the national economy by creating new and improved products, increased employment, and provides a stimulus to education. The exploration of the Moon and Mars under the Space Exploration Initiative has the potential of accelerating this stimulates to the economy. It is difficult to identify all of the concrete ways this will be accomplished. However, many areas can be identified. The space exploration building blocks of power, propulsion, spacecraft, robotics, rovers, mining and manufacturing, communications, navigation, habitats, life support and infrastructures are reviewed to identify possible technology areas. For example, better means for working in hazardous areas and handling hazardous waste are potential outcomes of this initiative. Methods to produce higher quality goods and improve America's competitiveness in manufacturing will undoubtedly evolve from the need to produce products that must last many years in the harsh environments of space and planetary surfaces. Some ideas for technology transfer are covered in this paper.

6794 (KAERI/RR–943/90) **Establishment of nuclear business management system.** Ahn, Jong Hwan (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Cho, Suk Hong; Oh, Du Sub; Kim, Sung Ki; Choi, Young Lok; Kim, Hwa Sup; Jun, Sang Jin; Yoon, Hyung Mo; Park, Jae Hong; Song, Tae Gil. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1991. 170p. (In Korean). Order Number DE92615171. Source: OSTI; NTIS (US Sales Only); INIS.

For the formulation of the technology development strategies the nuclear core technology, environmental analysis has been performed in four aspects: ecological environment, energy economy, nuclear policy and R and D environment. After analyzing the environment and identifying the opportunities and threats from the environment, the strategies on individual and organizational level have been developed for both of the short-term and long-term periods. For the betterment of nuclear business management, the management information system, management by objective and the mechanism for the enhancement of negotiation power in the international agreement have been studied. (Author).

6795 (ORNL/PPA–90/1) **ORNL '90.** Anderson, T.; Barnes, D.; Jefferson, J. (eds.). Oak Ridge National Lab., TN (United States). [1990]. 62p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract AC05-84OR21400. Order Number DE92004801. Source: OSTI; NTIS; GPO Dep.

This overview of research conducted at ORNL in 1991 presents information on the subjects of biology, physics, and the environment. Specific topics include gene mutations in kidney disease, technology assessments in thermonuclear fusion, submarine hunting technology, ozone-safe refrigerants, optical data storage via surface enhanced raman spectroscopy, and waste mitigating microbes. (GHH)

2906 Nuclear Energy

Refer also to citation(s) 6613, 6614, 6794, 6801

6796 (BfS–3/91) **Bundesamt fuer Strahlenschutz.** Bundesamt fuer Strahlenschutz, Salzgitter (Germany). Sep 1991. 23p. (In German, English). Order Number DE92759233. Source: OSTI; NTIS (US Sales Only); INIS.

Presented are organization and tasks of the departments of the BfS: Central Department Z (administration, legal concerns); Department S Radiation Hygiene; Department ST Radiation Protection; Department KT Nuclear Safety; Department ET Nuclear Waste Management and Transport. (HP).

6797 (EGG-M–91483) **The roles and functions of a lunar base Nuclear Technology Center.** Buden, D. (EG and G Idaho, Inc., Idaho Falls, ID (United States)); Angelo, J.A. Jr. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1991]. 9p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-9110217–4: 42. International Aeronautical Federation Congress (IAEFC), Montreal (Canada), 7-11 Oct 1991). Order Number DE92003325. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes the roles and functions of a special Nuclear Technology Center which is developed as an integral part of a permanent lunar base. Numerous contemporary studies clearly point out that nuclear energy technology will play a major role in any successful lunar/Mars initiative program and in the overall establishment of humanity's solar system civilization. The key role of nuclear energy in the providing power has been recognized. A Nuclear Technology Center developed as part of of a permanent lunar base can also help bring about many other nuclear technology applications, such as producing radioisotopes for self-illumination, food preservation, waste sterilization, and medical treatment; providing thermal energy for mining, materials processing and agricultural; and as a source of emergency habitat power. Designing such a center will involve the deployment, operation, servicing and waste product management and disposal of megawatt class reactor power plants. This challenge must be met with a minimum of direct human support at the facility. Furthermore, to support the timely, efficient integration of this Nuclear Technology Center in the evolving lunar base infrastructure, an analog of such a facility will be needed here on Earth. 12 refs., 4 figs., 1 tab.

6798 (KFK–4735) **Results of research and development activities in 1989 of the Institute for Neutron Physics and Reactor Technology.** Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Neutronenphysik und Reaktortechnik. Mar 1990. 34p. (In German). Order Number DE92750123. Source: OSTI; NTIS (US Sales Only); INIS.

The Institute for Neutron Physics and Reactor Technology treats research problems of nuclear engineering, mainly those that are related to the development of sodium-cooled fast breeder reactors and fusion reactor technology. The activities are in approximately equal parts of an experimental and theoretical nature. A great part of the research activities is performed in co-operation with other institutes and industrial groups in the framework of projects. For the Fast Breeder Reactor Project the Institute works on reactor physical design and safety problems by the core of large-scale fast breeder reactors. Questions concerning the consequences of accidents in light water reactors upon the environment and the population are treated as part of the Nuclear Safety Project. The Institute contributes to the Reprocessing Project with theoretical investigations on the physics of the fuel cycle and by developing control devices for a reprocessing plant. In the framework of the Fusion Project the Institute is concerned with neutron physical and technological questions of the breeder blanket. (orig.).

6799 (SKN–50) **Women, men and nuclear power.** Oskarson, M. National Board for Spent Nuclear Fuel, Stockholm (Sweden). Aug 1991. 62p. (In Swedish). Order Number DE92614084. Source: OSTI; NTIS (US Sales Only); INIS.

Men and women show different attitudes towards nuclear power and the reason for that has been studied. The results are presented in this report. (K.A.E.).

6800 (WHC-SA–1273) **Beneficial uses of radiation.** Fox, M.R. Westinghouse Hanford Co., Richland, WA (United States). Oct 1991. 13p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE92003024. Source: OSTI; NTIS; INIS; GPO Dep.

An overall decline in technical literacy within the American public has come at a time when technological advances are accelerating in the United States and around the world. This had led to a large communication gulf between the general public and the technologists. Nowhere is this more evident then with the topic of radiation. Regrettably, too few people know about sources of radiation, the pervasiveness, amounts, and variabilities, and do not have a true understanding of the environment in which we live. Nor do many people know that radiation has been used in beneficial ways for decades around the world. While the general public does not know of the scientific applications to which radiation has been deployed, it nevertheless had benefited tremendously from these efforts. Thanks to the well know properties of radiation, scientific ingenuity has found many uses of radiation in chemical and agricultural research, biomedical research, in the diagnoses and treatment of hundreds of types of diseases, in industrial applications, food irradiation, and many others. This paper provides a sample of the types of uses to which radiation has been used to help advance the betterment of humankind.

2910 Conservation

Refer also to citation(s) 6859

2920 Supply, Demand, and Forecasting

Refer also to citation(s) 6857

6801 (KURRI-TR–345, pp. 81-91) **Spallation symbiont and thorium breeding.** Furukawa, Kazuo (Tokai Univ., Hiratsuka, Kanagawa (Japan). Inst. of Research and Development). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Mar 1991. (In Japanese). (CONF-9008225–: Specialists' meeting on physics and engineering of fission and spallation; Specialists' meeting on physics and engineering of fission and spallation, Kumatori (Japan); Kumatori (Japan), 2 Aug 1990; 10 jan 1991; CONF-9101117–). In *Proceedings of the specialists' meeting on physics and engineering of fission and spallation, 1990.* 118p. Order Number DE92713857. Source: OSTI; NTIS (US Sales Only); INIS.

The medium term world energy and environment countermeasures for 2020-2070 are not yet clearly established. The forecast of energy situation hereafter, its problems and the measures for solution are considered. World trend is removing borders, and the north-south problems are increasing the importance. The rational and clear idea with the support of concrete technology is required. The demand of energy will increase enormously at the annual rate of 2.3%. The world energy situation was forecast considering the increase of population, and it will be 115 TW at the end of the next century. The present status, problems and the countermeasures in nuclear fission energy technology are explained. The countermeasures should be based on three principles, namely Th-U-233 cycle, the utilization of molten fluoride fuel medium and the separation of molten salt breeders and molten salt reactors. Accelerator molten salt breeders, small molten salt reactors, the nuclear fuel cycle and the annihilation process for radioactive wastes are reported. The perspective that the nuclear energy system, in which the reactor safety, the measures to wastes and others are improved by the spallation-fission symbiont using thorium molten salt as the working medium, can be constructed is shown. (K.I.).

2930 Policy, Legislation, and Regulation

Refer also to citation(s) 6616, 6619, 6620, 6624

6802 (CERCLA–005/1091) **Compendium of CERCLA ARARs fact sheets and directives.** Environmental Protection Agency, Washington, DC (United States). Office of Emergency and Remedial Response; USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (United States). Office of Environmental Guidance. Oct 1991. 254p. Sponsored by U.S. DOE Environment Safety & Health; Environmental Protection Agency. Order Number DE92004878. Source: OSTI; NTIS; GPO Dep.

Section 121 (d) of the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), requires attainment of Federal and State applicable and relevant and appropriate requirements (ARARs). Subparts E, Section 300.400(g) "Identification of applicable or relevant and appropriate requirements" of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (55 CFR 8666, March 8, 1990) describes the process for attaining ARARs. The purpose of this compendium is to provide you with a complete and current source of "Quick Reference Fact Sheets" and Directives on applicable and relevant and appropriate requirements (ARARs). These fact sheets provide overviews of the ARARs for CERCLA cleanup actions. The Compendium of CERCLA ARARs consists of seven (7) chapters: lists of general fact sheets that provide introductory information on ARARs; Chapter 2 discusses air emissions from Superfund air strippers; Chapter 3 deals with Indian Tribal involvement in the Superfund program; Chapter 4 discusses soil lead cleanup levels at Superfund sites; Chapter 5 discusses the risk associated with Superfund cleanups; Chapter 6 contains four sections that discuss a variety of RCRA ARARs such as general guidance topics, land disposal restrictions, Superfund LDR guides, and toxicity characteristics; and finally, Chapter 7 contains a variety of ARAR fact sheets and directives on Wastewater, Safe Drinking Water Act and Groundwater.

6803 (DOE/OR/00033–T448) **R&D project selection models in the US Department of Energy.** Roessner, J.D. (Georgia Inst. of Tech., Atlanta, GA (USA). School of Social Sciences). Oak Ridge Associated Universities, Inc., TN (United States); Georgia Inst. of Tech., Atlanta, GA (United States). School of Social Sciences. 30 Sep 1981. 46p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract AC05-76OR00033. Order Number DE91014924. Source: OSTI; NTIS; GPO Dep.

This report examines the use of formal, quantitative R&D project selection models in the US Department of Energy (DOE). It details the characteristics and operation of major models currently used in DOE (at least on a trial basis); it discusses the functions that R&D project selection models perform within broader managerial and budgetary decision-making processes within DOE; and it compares the models used in DOE and the functions they performs with the situation in other federal agencies and in private industry. The objectives of the report are to inform DOE officials and others about the types of models used in DOE, identity some of the advantages and limitations of using quantitative project selection models to aid R&D budget decisionmaking, and provide insights into the interplay between the models and the organizational and political contexts in which they are used.

6804 (SAND–89-2075) **Export control and licensing at Sandia National Laboratories.** Sandia National Labs., Albuquerque, NM (United States). Aug 1990. 20p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE92005369. Source: OSTI; NTIS; GPO Dep.

Sandia is committed to a policy of adherence to all US export control laws and regulations. The export of technical data, software, or hardware will be accomplished in accordance with Federal agencies' export control regulations. Sandia employees at all levels are responsible to ensure that exports are accomplished in compliance with export control laws and regulations. This booklet explains these export control laws and regulations.

2940 Fossil Fuels

Refer also to citation(s) 6098, 6233, 6284, 6286, 6303, 6304, 6305, 6309, 6773, 6783, 6792

6805 (ANL/CP–74782) **Clean coal technology and acid rain compliance: An examination of alternative incentive proposals.** McDermott, K.A. (Center for Regulatory Studies, Normal, IL (United States)); South, D.W. Argonne National Lab., IL (United States). [1991]. 13p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-31109-ENG-38. (CONF-9104106–7: 53. annual American power conference, Chicago, IL (United States), 29 Apr - 1 may 1991). Order Number DE92004126. Source: OSTI; NTIS; GPO Dep.

The Clean Air Act Amendments (CAAA) of 1990 rely primarily on the use of market incentives to stimulate least-cost compliance choices by electric utilities. Because of the potential risks associated with selecting Clean Coal Technologies (CCTs) and the public-good nature of technology commercialization, electric utilities may be reluctant to adopt CCTs as part of their compliance strategies. This paper examines the nature of the risks and perceived impediments to adopting CCTs as a compliance option. It also discusses the incentives that regulatory policy makers could adopt to mitigate these barriers to CCT adoption. (VC)

6806 (CONF-910571–, pp. 3-22) **The clean coal initiative: An appropriate response to complex environmental issues.** Miller, C.L. (Dept. of Energy, Washington, DC (United States)). North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center. [1991]. From 16. biennal low-rank fuels symposium; Billings, MT (United States); 20-23 May 1991. In *Proceedings of the sixteenth biennial low-rank fuels symposium.* 535p. Order Number DE92002606. Source: OSTI; NTIS; INIS.

The paper discusses the Department of Energy's Clean Coal Technology Program that can offer significant benefits when these technologies are used for power production, pollution control or the conversion of coal into other alternative energy products. The paper describes the status of the program, the 35 projects currently in the program, and the environmental role of clean coal technologies.

6807 (DOE/EIA–0035(91/11)) **Monthly energy review, November 1991.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. 25 Nov 1991. 154p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. Order Number DE92004651. Source: OSTI; NTIS; INIS; GPO; GPO Dep.

This report presents current data on production, consumption, stocks, imports, exports, and prices of the principal energy commodities in the United States. Also included are data on international production of crude oil, consumption of petroleum products, petroleum stocks, and production of electricity from nuclear-powered facilities. 30 figs., 57 tabs.

6808 (DOE/EIA–0035(91/12)) **Monthly energy review, December 1991.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. 23 Dec 1991. 154p. Sponsored by U.S. DOE Energy Information Administration. Order Number DE92004204. Source: OSTI; NTIS; GPO; GPO Dep.

This publication contains data and informative feature articles pertaining to various energy sources. The following topics are discussed: Section 1. energy overview; section 2. energy consumption; Section 3. petroleum; Section 4. natural gas; Section 5.

Oil and gas resource development; Section 6. Coal; Section 7. electricity; Section 8. nuclear energy; Section 9. energy prices and Section 10. international energy. Appendix conversion factors a glossary is included. 57 tabs.,

6809 (DOE/EIA–0109(91/11)) **Petroleum supply monthly, November 1991.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 29 Nov 1991. 147p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. Order Number DE92003960. Source: OSTI; NTIS; GPO; GPO Dep.

The Petroleum Supply Monthly (PSM) is one of a family of three publications produced by the Petroleum Supply Division within the Energy Information Administration (EIA) reflecting different levels of data timeliness and completeness. The other two publications are the Weekly Petroleum Status Report (WPSR) and the Petroleum Supply Annual (PSA). Data presented in the PSM describe the supply and disposition of petroleum products in the United States and major US geographic regions. The data series describe production, imports and exports, inter-Petroleum Administration for Defense (PAD) District movements, and inventories by the primary suppliers of petroleum products in the United States (50 States and the District of Columbia). The reporting universe includes those petroleum sectors in Primary Supply. Included are: petroleum refiners, motor gasoline blenders, operators of natural gas processing plants and fractionators, inter-PAD transporters, importers, and major inventory holders of petroleum products and crude oil. When aggregated, the data reported by these sectors approximately represent the consumption of petroleum products in the United States. 14 figs.

6810 (DOE/EIA–0109(91/12)) **Petroleum supply monthly, December 1991.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 31 Dec 1991. 147p. Sponsored by U.S. DOE Energy Information Administration. Order Number DE92004926. Source: OSTI; NTIS; GPO; GPO Dep.

The Petroleum Supply Monthly (PSM) is one of a family of three publications produced by the Petroleum Supply Division within the Energy Information Administration (EIA) reflecting different levels of data timeliness and completeness. The other two publications are the Weekly Petroleum Status Report (WPSR) and the Petroleum Supply Annual (PSA). Data presented in the PSM describe the supply and disposition of petroleum products in the United States and major US geographic regions. The data series describe production, imports and exports, inter-Petroleum Administration for Defense (PAD) District movements, and inventories by the primary suppliers of petroleum products in the United States (50 States and the District of Columbia). The reporting universe includes those petroleum sectors in Primary Supply, Included are: petroleum refiners, motor gasoline blenders, operators of natural gas processing plants and fractionators, inter-PAD transporters, importers, and major inventory holders of petroleum products and crude oil. When aggregated, the data reported by these sectors approximately represent the consumption of petroleum products in the United States.

6811 (DOE/EIA–0130(91/11)) **Natural gas monthly, November 1991.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 12 Dec 1991. 137p. Sponsored by U.S. DOE Energy Information Administration. Order Number DE92004165. Source: OSTI; NTIS; GPO; GPO Dep.

This report highlights activities, events, and analyses of interest to public and private sector organizations associated with the natural gas industry. Volume and price data are presented each month for natural gas production, distribution, consumption, and interstate pipeline activities. Producer-related activities and underground storage data are also reported. From time to time, the natural gas monthly (NGM) features articles designed to assist readers in using and interpreting natural gas information. 7 figs., 33 tabs.

6812 (DOE/EIA–0202(91)) **Short-term energy outlook: Annual supplement 1991.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. 18 Nov 1991. 41p. Sponsored by U.S. DOE Energy Information Administration. Order Number DE92003655. Source: OSTI; NTIS; GPO; GPO Dep.

This report is published once a year as a complement to the Short-Term Energy Outlook (Outlook), quarterly projections. The purpose of the supplement is to review the accuracy of the forecasts published in the Outlook, make comparisons with other independent energy forecasts, and examine current energy topics that affect the forecasts. Included in the report is an evaluation of the accuracy of the short-term energy forecasts published in the last six issues of the Outlook, for 1990 through the first half of 1991 and a comparison of EIA's based or "mid" case energy projections as published in the second quarter 1991 Outlook with recent projections made by five other major forecasting groups. The section focuses on macroeconomic assumptions, primary energy demand, and primary energy supply showing the differences and similarities in the six forecasts. A chapter describing the comparison of Bayesian VAR and unrestricted VAR forecasting models of motor gasoline and distillate fuel prices and quantities is also included. 13 figs., 6 tabs.

6813 (DOE/EIA–0380(91/12)) **Petroleum marketing monthly, December 1991.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 19 Dec 1991. 183p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. Order Number DE92005134. Source: OSTI; NTIS; GPO; GPO Dep.

This report the Petroleum Marketing Monthly (PMM) is designed to give information and statistical data about a variety of crude oils and refined petroleum products. The publication provides statistics on crude oil costs and refined petroleum products sales for use by industry, government, private sector analysts, educational institutions, and consumers. Data on crude oil include the domestic first purchase price, the f.o.b. and landed cost of imported crude oil, and refiners' acquisition cost of crude oil. Sales data for motor gasoline, distillates, residuals, aviation fuels, kerosene, and propane are presented. 12 figs., 55 tabs.

6814 (DOE/EIA–0487(90)) **Petroleum marketing annual, 1990.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 24 Dec 1991. 430p. Sponsored by U.S. DOE Energy Information Administration. Order Number DE92005324. Source: OSTI; NTIS; INIS; GPO; GPO Dep.

The Petroleum Marketing Annual contains statistical data on a variety of crude oils and refined petroleum products. The publication provides statistics on crude oil costs and refined petroleum products sales for use by industry, government, private sector analysts, educational institutions, and consumers. Data on crude oil include the domestic first purchase price, the free-on-board and landed cost of imported crude oil, and the refiners' acquisition cost of crude oil. Sales data for motor gasoline, distillates, residuals, aviation fuels, kerosene, and propane are presented. (VC)

6815 (DOE/EIA–0520(91/11)) **International pertroleum statistics report, November 1991.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. 27 Nov 1991. 60p. Sponsored by U.S. DOE Energy Information Administration. Order Number DE92003717. Source: OSTI; NTIS; GPO; GPO Dep.

This report presents data on international oil production, consumption, imports, exports, and stocks. The report has four sections. Section 1 contains time series data on world oil production, and on oil consumption and stocks in the Organization for Economic Cooperation and Development (OECD). This section contains annual data beginning in 1980, and monthly data for the most recent two years. Section 2 presents an oil supply/consumption balance for the market economies (i.e. non-communist countries). This balance is presented in quarterly intervals for the most recent two years. Section 3 presents data on oil imports by OECD countries. This section contains annual data for the most recent year, quarterly data for the most recent two quarters, and monthly data for the most recent twelve months. Section 4 presents annual time series data on world oil production and oil stocks, consumption, and trade in OECD countries. World oil production and OECD consumption data are for the year 1970 through 1990; OECD stocks from 1973 through 1990; and OECD trade from 1982 through 1990. 41 tabs.

6816 (DOE/EIA-0520(91/12)) **International petroleum statistics report, December 1991.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. 23 Dec 1991. 60p. Sponsored by U.S. DOE Energy Information Administration. Order Number DE92004164. Source: OSTI; NTIS; GPO; GPO Dep.

The International Petroleum Statistics Report presents data on international oil production, consumption, imports, exports, and stocks. The report has four sections. Section 1 contains time series data on world oil production, and on oil consumption and stocks in the Organization for Economic Cooperation and Development (OECD). This section contains annual data beginning in 1980, and monthly data for the most recent two years. Section 2 presents an oil supply/consumption balance for the market economics (i.e. non-communist countries). This balance is presented in quarterly intervals for the most recent two years. Section 3 presents data on oil imports by OECD countries. This section contains annual data for the most recent year, quarterly data for the most recent two quarters, and monthly data for the most recent twelve months. Section 4 presents annual time series data on world oil production and oil stocks, consumption, and trade in OECD countries. World oil production and OECD consumption data are for the years 1970 through 1990; OECD stocks from 1973 through 1990; and OECD trade from 1982 through 1990.

6817 (DOE/EIA-0538(91/92-9)) **Winter fuels report, week ending November 22, 1991.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 27 Nov 1991. 70p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. Order Number DE92004689. Source: OSTI; NTIS; GPO Dep.

This Report is intended to provide concise, timely information to the industry, the press, policymakers, consumers, analysts, and State local governments on the following topics: distillate fuel oil net production, imports and stocks for all Petroleum Administration for Defense Districts (PADD) and product supplied on a US level; propane net production, imports and stocks for PADD's 1, 2, and 3; natural gas supply and disposition and underground storage for the United States and consumption for all PADD's; residential and wholesale pricing data for propane and heating oil for those States participating in the joint Energy Information Administration (EIA)/State Heating Oil and Propane Program; crude oil and petroleum price comparisons for the United States and selected cities; and US total heating degree-days by city. 37 figs., 13 tabs.

6818 (DOE/EIA-0538(91/92-10)) **Winter fuels report, week ending November 29, 1991.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 5 Dec 1991. 70p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. Order Number DE92003959. Source: OSTI; NTIS; GPO Dep.

The Winter Fuels Report is intended to provide concise, timely information to the industry, the press, policymakers, consumers, analysts, and State and local governments on the following topics: distillate fuel oil net production, imports and stocks for all Petroleum Administration for Defense Districts (PADD) and product supplied on a US level; propane net production, imports and stocks for PADD's I, II, and III; natural gas supply and disposition and underground storage for the United States and consumption for all PADD's; residential and wholesale pricing data for propane and heating oil for those States participating in the joint Energy Information Administration (EIA)/State Heating Oil and Propane Program; crude oil and petroleum price comparisons for the United States and selected cities; and US total heating degree-days by city. 37 figs.

6819 (DOE/EIA-0538(91/92-11)) **Winter fuels report, week ending December 6, 1991.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 12 Dec 1991. 70p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. Order Number DE92004725. Source: OSTI; NTIS; GPO; GPO Dep.

This report is intended to provide concise, timely information to the industry, the press, policymakers, consumers, analysts, and State and local governments on the following topics: distillate fuel oil net production, imports and stocks for all Petroleum Administration for Defense Districts (PADD) and product supplied on a US level; propane net production, imports and stocks for PADD's 1, 2, and 3; natural gas supply and disposition and underground storage for the United States and consumption for all PADD's; residential and wholesale pricing data for propane and heating oil for those States participating in the joint Energy Information Administration (EIA)/State Heating Oil and Propane Program; crude oil and petroleum price comparisons for the United States and selected cities; and US total heating degree-days by city.

6820 (DOE/EIA-0538(91/92-12)) **Winter fuels report, week ending December 13, 1991.** USDOE Energy Information Administration, Washington, DC (United States). Office of Oil and Gas. 19 Dec 1991. 70p. Sponsored by U.S. DOE Energy Information Administration. Order Number DE92004812. Source: OSTI; NTIS; GPO; GPO Dep.

This Report is intended to provide concise, timely information to the industry, the press, policymakers, consumers, analysts, and State and local governments on the following topics: distillate fuel oil net production, imports and stocks for all Petroleum Administration for Defense Districts (PADD) and product supplied on a US level; propane net production, imports and stocks for PADD's 1, 2, and 3; natural gas supply and disposition and underground storage for the United States and consumption for all PADD's; residential and wholesale pricing data for propane and heating oil for those States participating in the joint Energy Information Administration (EIA)/State Heating Oil and Propane Program; crude oil and petroleum price comparisons for the United States and selected cities; and US total heating degree-days by city.

6821 (DOE/EIA-0543(91/3Q)) **US energy industry financial developments, 1991 third quarter.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. 11 Dec 1991. 15p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. Order Number DE92004795. Source: OSTI; NTIS; INIS; GPO; GPO Dep.

Net income for the 218 energy companies included in this report was 15 percent lower in the third quarter of 1991 than in the third quarter of 1990. Declining income from oil and natural gas production, chemical operations, and coal operations resulted in a 33-percent fall in income for fossil fuel companies. The other category of energy companies included in this report, rate-regulated utilities, recorded essentially no change in income.

6822 (ORNL-6683) **Navy mobility fuels forecasting system report: World petroleum trade forecasts for the year 2000.** Das, S. Oak Ridge National Lab., TN (United States). Dec 1991. 45p. Sponsored by U.S. Department of Defense. DOE Contract AC05-84OR21400. Order Number DE92004085. Source: OSTI; NTIS; GPO Dep.

The Middle East will continue to play the dominant role of a petroleum supplier in the world oil market in the year 2000, according to business-as-usual forecasts published by the US Department of Energy. However, interesting trade patterns will emerge as a result of the democratization in the Soviet Union and Eastern Europe. US petroleum imports will increase from 46% in 1989 to 49% in 2000. A significantly higher level of US petroleum imports (principally products) will be coming from Japan, the Soviet Union, and Eastern Europe. Several regions, the Far East, Japan, Latin American, and Africa will import more petroleum. Much uncertainty remains about of the level future Soviet crude oil production. USSR net petroleum exports will decrease; however, the United States and Canada will receive some of their imports from the Soviet Union due to changes in the world trade patterns. The Soviet Union can avoid becoming a net petroleum importer as long as it (1) maintains enough crude oil production to meet its own consumption and (2) maintains its existing refining capacities. Eastern Europe will import approximately 50% of its crude oil from the Middle East.

2960 Electric Power

Refer also to citation(s) 6807, 6808, 6812

6823 (DOE/EIA-0226(91/11)) **Electric power monthly, November 1991.** USDOE Energy Information Administration, Washington, DC (United States). Office of Coal, Nuclear, Electric and Alternate Fuels. 18 Nov 1991. 199p. Sponsored by U.S. DOE Energy Information Administration. Order Number DE92003715. Source: OSTI; NTIS; GPO; GPO Dep.

This publication provides monthly statistics at the national, Census division, and State levels for net generation, fuel consumption, fuel stocks, quantity and quality of fuel, cost of fuel, electricity sales, revenue, and average revenue per kilowatthour of electricity sold. Data on net generation, fuel consumption, fuel stocks, quantity and cost of fuel are also displayed at the North American Electric Reliability Council (NERC) region level. Additionally, statistics at the company and plant level are published in the EPM on capability of new plants, net generation, fuel consumption, fuel stocks, quantity and quality of fuel, and cost of fuel. 4 figs., 63 tabs.

6824 (ORNL/CON-340) **The effects of utility DSM programs on electricity costs and prices.** Hirst, E. Oak Ridge National Lab., TN (United States). Nov 1991. 51p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE92004595. Source: OSTI; NTIS; GPO Dep.

More and more US utilities are running more and larger demand-side management (DSM) programs. Assessing the cost-effectiveness of these programs raises difficult questions for utilities and their regulators. Should these programs aim to minimize the total cost of providing electric-energy services or should they minimize the price of electricity? This study offers quantitative estimates on the tradeoffs between total costs and electricity prices. This study uses a dynamic model to assess the effects of energy-efficiency programs on utility revenues, total resource costs, electricity prices, and electricity consumption for the period 1990 to 2010. These DSM programs are assessed under alternative scenarios. In these cases, fossil-fuel prices, load growth, the amount of excess capacity the utility has in 1990, planned retirements of power plants, the financial treatment of DSM programs, and the costs of energy- efficient programs vary. These analyses are conducted for three utilities: a "base" that is typical of US utilities; a "surplus" utility that has excess capacity, few planned retirements, and slow growth in fossil-fuel prices and incomes; and a "deficit" utility that has little excess capacity, many planned retirements, and rapid growth in fossil-fuel prices and incomes. 28 refs.

2980 Consumption and Utilization

Refer also to citation(s) 6288

2990 Unconventional Sources and Power Generation

Refer also to citation(s) 6535, 6549

6825 (IEE-SR-223) **Introduction of renewable energy to Japan and feasibility study on reduction of environmental load.** Institute of Energy Economics, Tokyo (Japan). Jul 1991. 159p. (In Japanese). Order Number DE92749185. Source: OSTI; NTIS (US Sales Only).

Possibility of substitution of renewable energy (RE) such as solar, biomass, hydraulic power, ocean, wind and geothermy is investigated to preserve the global environment and solve the energy source depletion problem. RE availability in Japan is 24×10^{14}kcal?y including 61×10^{10}kWh?y of electric power and 10×10^{14}kcal?y of heat quantity (electric power is multiplied by 2.7 for conversion to calorie, with thermal power generation efficiency as 37%). For the time being, the target for 2030 is 9×10^{14}kcal?y in total which is equivalent to petroleum substitution of 97 million kl and CO_2 reduction of 270 million tons. When fossil fuels are subsituted for RE, costs of CO_2 recovery?fixation calculated from CO_2 discharge amount, carbon tax to be paid, environmental damage are added to the fossil fuel cost as a social cost. With this, a wide use of RE is evaluated as a merit. As for the target for 2030 set for the present, cost of CO_2 fixation, carbon tax and environmental damage are annually 1.8 trillion yen, 0.72 - 6.7 trillion yen and 3.9 - 6.7 trillion yen, respectively. 7 figs., 19 tabs.

30 DIRECT ENERGY CONVERSION

3001 MHD Generators

Refer also to citation(s) 6551, 6556, 6557

6826 (CONF-9102112-Absts., pp. 1-81) **MHD Integrated Topping Cycle (ITC) project.** Bauer, J.M. (TRW Space and Technology Group, Redondo Beach, CA (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). [1991]. DOE Contract AC22-87PC90274. From Magnetohydrodynamic (MHD) contractors review meeting; Pittsburgh, PA (United States); 19-21 Feb 1991. In *MHD contractor's review meeting. Abstracts.* 314p. Order Number DE91011295. Source: OSTI; NTIS.

The objectives of the Integrated Topping Cycle project are to design, construct, and deliver all prototypical hardware necessary to conduct long duration integrated MHD topping cycle proof-of-concept tests at the Component Development and Integration Facility (CDIF) in Butte, Montana. The results of the long duration tests will augment the existing engineering data base on MHD power train reliability, maintainability, durability, and performance, and will serve as a basis for scaling up the early commercial scale power plant retrofit. The components of the MHD power train to be designed, fabricated, and tested include the following: a slagging coal combustion subsystem with a rated capacity of 50 MW thermal input, capable of operation with eastern (Illinois #6) or western (Montana Rosebud) coal; a channel subsystem consisting of a segmented supersonic nozzle, channel (with current controls), and diffuser, capable of power output of 1.5 Mw(e); and a current consolidation subsystem to interface the channel with the existing facility inverter. The paper discusses the work completed on the following: systems engineering and data analysis; combustion subsystem design; channel subsystem design; current consolidation subsystem design; and CDIF testing.

6827 (CONF-9102112-Absts., pp. 82-153) **Activity summary for the Department of Energy's Component Development and Integration Facility (CDIF).** Sherick, J.M. (MSE, Inc., Butte, MT (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). [1991]. DOE Contract AC07-88ID12735. From Magnetohydrodynamic (MHD) contractors review meeting; Pittsburgh, PA (United States); 19-21 Feb 1991. In *MHD contractor's review meeting. Abstracts.* 314p. Order Number DE91011295. Source: OSTI; NTIS.

The Component Development and Integration Facility (CDIF) is an engineering scale, development test facility for magnetohydrodynamic (MHD) topping cycle components operated for the US Department of Energy by MSE, Inc. The major objective of the CDIF is to obtain MHD test results that will provide the design basis for larger scale MHD components, which is in support of DOE's commitment to the MHD development and proof-of-concept program. Included is support for the National MHD Environmental Program that provides research on environmental issues specific to MHD, evaluation of environmental test data from the CDIF and the Coal-Fired Flow Facility (CFFF), support for the development of an MHD technical data base, and ambient air quality monitoring at the CDIF. The paper discusses work completed on the following: facility ES and H compliance issues; facility support; testing and evaluation; test hardware support; and national MHD environmental program.

6828 (CONF-9102112-Absts., pp. 154-230) **MHD bottoming cycle component testing at the Coal Fired Flow Facility.** Muehlhauser, J.W. (Univ. of Tennessee Space Inst., Tullahoma (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). [1991]. DOE Contract AC02-79ET10815. From Magnetohydrodynamic (MHD) contractors review meeting; Pittsburgh, PA (United States); 19-21 Feb 1991. In *MHD contractor's review meeting. Abstracts.* 314p. Order Number DE91011295. Source: OSTI; NTIS.

The emphasis at UTSI has been to provide technology needed for scaleup of heat recovery, seed recovery components, including corrosion and erosion, slagging and fouling of heat transfer surfaces, seed recovery, control of priority pollutants and particulate emissions, heat transfer, system integration, and waste management and environmental concerns. The paper summarized three performance tests with bituminous coal, then discusses results from component development and test facility modifications under the following headings: automated ash/seed handling system; high pressure sootblower system; high temperature air heater; convection enhancement; superheater test module tube corrosion; ash deposition; baghouse; electrostatic precipitator; pollution control; and gas phase chloride measurement.

6829 (CONF-9102112–Absts., pp. 231-250) **MHD heat recovery and seed recovery system development.** McIlroy, R.A. USDOE Pittsburgh Energy Technology Center, PA (United States). [1991]. DOE Contract AC02-79CH10018. From Magnetohydrodynamic (MHD) contractors review meeting; Pittsburgh, PA (United States); 19-21 Feb 1991. In *MHD contractor's review meeting. Abstracts.* 314p. Order Number DE91011295. Source: OSTI; NTIS.

The objective is to develop a technology base for the design of Heat Recovery Seed Recovery (HRSR) systems for central station MHD Electric Power Plants. The commercial plant designers reviewed a summary of the operating conditions within the various components and the test data that was being gathered. They expressed concern about the lack of data on materials compatibility in the higher temperature zones of the radiant furnace and in the diffuser. The author started the task of gathering steady state data that the designers, B&W's and those of other steam generator suppliers, could use to develop scale up methods and procedures. He is attempting to make available files of steady state data for: heat transfer to the diffuser, the radiant furnace and the furnace downstream of the secondary combustor; heat transfer to the superheater test module, SHTM, test sections and cooling sections and the air heater; gaseous emissions data and conditions affecting emissions such as primary and secondary stoichiometries, temperatures and temperature decay rates, potassium to sulfur ratios, etc.; ESP performance and data on conditions affecting the performance; BH performance and conditions affecting the performance; dense phase feed system and flow measurement; operating conditions of corrosion and deposition probes; and performance of sootblowers and SHTM, including metal temperatures and sootblower operating conditions.

6830 (CONF-9102112–Absts., pp. 251-273) **Diagnostic development and support of MHD test facilities.** Shepard, W.S. (Mississippi State Univ., Mississippi State (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). [1991]. DOE Contract AC02-80ET15601. From Magnetohydrodynamic (MHD) contractors review meeting; Pittsburgh, PA (United States); 19-21 Feb 1991. In *MHD contractor's review meeting. Abstracts.* 314p. Order Number DE91011295. Source: OSTI; NTIS.

The objective of the Diagnostic Instrumentation and Analysis Laboratory's DOE contract is to develop advanced optical and laser-based techniques and computer-controlled instrumentation systems for characterization of MHD and HRSR gas streams; and provide field measurements for direct diagnostic support of MHD engineering development test facilities. The paper discusses operation and performance of the instruments developed to measure furnace flow profiles, surface temepratures, gas temperature, potassium atom number density, gas point temperature, and particle size. The multi-purpose imaging system, the Faraday rotation system, the differential absorption laser spectrometer, and the laser optogalvanic spectrometer are described.

6831 (CONF-9102112–Absts., pp. 274-296) **Heat and seed recovery technology project.** Swift, W.M. (Argonne National Lab., IL (United States)); Petrick, M.; Natesan, K. USDOE Pittsburgh Energy Technology Center, PA (United States). [1991]. From Magnetohydrodynamic (MHD) contractors review meeting; Pittsburgh, PA (United States); 19-21 Feb 1991. In *MHD contractor's review meeting. Abstracts.* 314p. Order Number DE91011295. Source: OSTI; NTIS.

The objective of this work is to address technical issues related to both the MHD topping and steam bottoming cycles and to their integration. Design information will be obtained through modeling and experimentation. This information, together with the results of the long duration testing at DOE's Coal Fired Flow Facility (CFFF) and Component Development and Integration Facility (CDIF), can be used to reliably design the first-generation MHD retrofit plant. Work during the reporting period focused on the following two major tasks: (1) computer modeling of the second stage of the TRW combustor and (2) evaluation of materials for the intermediate temperature air heater, the MHD channel, and the MHD combustor. Accomplishments in these areas are briefly described in the following sections.

6832 (CONF-9102112–Absts., pp. 297-305) **TRW Econoseed process for MHD seed recovery and regeneration.** McClanathan, L.C. (TRW Applied Technology Div., Redondo Beach, CA (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). [1991]. DOE Contract AC22-87PC79672. From Magnetohydrodynamic (MHD) contractors review meeting; Pittsburgh, PA (United States); 19-21 Feb 1991. In *MHD contractor's review meeting. Abstracts.* 314p. Order Number DE91011295. Source: OSTI; NTIS.

The Phase 2 Proof-of-Concept (POC) test program is aimed at the development of a process that will economically recover and regenerate potassium seed used in the combustion of high sulfur coals in MHD systems. The program objectives are to: (1) design, construct and operate a POC test plant to demonstrate the process technology using actual high sulfur seed (Illinois No. 6) from UTSI, (2) to produce tonnage quantities of recycled seed for testing at the CDIF facility, (3) to design, construct and operate a separate, smaller scale POC unit to demonstrate the production of feed material calcium formate from lime and CO gas based on proof-of-principle experiments performed by Union Carbide in the early 1950's, and (4) to collect operating and equipment data to update the desing and process economics for a seed regeneration system that will support a 300 MW(t) MHD system. Work completed to date is described.

6833 (CONF-9106303–, pp. 173-176) **Corrosion and arc erosion in MHD channels.** Rosa, R.J. (Montana State Univ., Bozeman (United States)); Pollina, R.J. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-88PC88928. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objective of this work is to study the corrosion and arc erosion of MHD materials in a cooperative effort with the MHD topping cycle program of DOE. Materials tested in the Avco Research Laboratory/Textron facility, or materials which have significant MHD importance, will be analyzed to document their physical deterioration. Conclusions shall be drawn about their wear mechanisms and lifetime in the MHD environment with respect to the following issues: sulfur corrosion, electrochemical corrosion, and arc erosion. The impact of any materials or slag conditions on the level of power output and on the level of leakage current in the MHD channel will also be noted, where appropriate. Last year a method for determining leakage current was developed and applied to a large quantity of test data from the DOE MHD facility in Butte, MT. This data reduction task continues as test results become available. The primary effort this year has been to understand the mechanisms responsible for leakage and how they affect electrode lifetime. To this end, by comparing data from many runs, the authors have sought correlations between the leakage values and various duct operation parameters. The resulting correlations have suggested three mechanisms plus a possible fourth which may together be responsible for most of the observed leakage. Results and mechanisms are summarized.

6834 (DOE/PC/79679–T1) **An MHD heat source based on intermetallic reactions: Final report, September 15, 1987–September 30, 1990.** Sadjian, H. (General Sciences, Inc., Souderton, PA (United States)); Zavitsanos, P.; Marston, C.H. General Sciences, Inc., Souderton, PA (United States). 6 May 1991. 72p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-87PC79679. Order Number DE92000036. Source: OSTI; NTIS; GPO Dep.

The main objective of this program was the development of an MHD heat source of potential use in Space - Based Multi

Megawatt, MHD Power Systems. The approach is based on extension of high temperature chemical/ion release technology developed by the General Sciences, Incorporated (GSI) team and successfully applied in other Space Applications. Solid state reactions have been identified which can deliver energy densities and electrons in excess of those from high energy explosives as well as other conventional fuels. The use of intermetallic reactions can be used to generate hot hydrogen plasma from the reaction, to create a high level of seedant ionization, can be packaged as a cartridge type fuels for discrete pulses. The estimated weight for energizing a (100 MW - 1000 sec) Pulsed MHD Power System can range from 12 to 25 × 10^3 kg depending on reaction system and strength of the magnetic field. The program consisted of two major tasks with eight subtasks designed to systematically evaluate these concepts in order to reduce fuel weight requirements. Laboratory measurements on energy release, reaction product identification and levels of ionization were conducted in the first task to screen candidate fuels. The second task addressed the development of a reaction chamber in which conductivity, temperature and pressure were measured. Instrumentation was developed to measure these parameters under high temperature pulsed conditions in addition to computer programs to reduce the raw data. Measurements were conducted at GSI laboratories for fuel weights of up to 120 grams and at the Franklin Research Center* for fuel weights up to 1 kilogram. The results indicate that fuel weight can be scaled using modular packaging. Estimates are presented for fuel weight requirements. 15 refs.

6835 (DOE/PC/88652–T7) **Development and application of diagnostic instrumentation for measurement of electron density and conductivity: Final technical progress report.** Bauman, L.E. Mississippi State Univ., MS (United States). Diagnostic Instrumentation and Analysis Lab. May 1990. 54p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-88PC88652. Order Number DE92002134. Source: OSTI; NTIS; GPO Dep.

The purpose of this contract was to assemble and demonstrate in the laboratory a Faraday rotation system for measurement of electron density and conductivity, with the intent to produce a system suitable for diagnostic support of the development of pulsed, space-based magnetohydrodynamic (MHD) power systems. Two system configurations were tested: (1) a rotating polarizer and (2) a beam splitting polarizer. Due to the short path length plasma produced in the laboratory flame, the long wavelength 496 μm methyl fluoride laser line was used and only the more sensitive rotating polarizer configuration was used for the demonstration experiments. Electron number densities from 2 × 10^{19} to 9 × 10^{19} were measured with good agreement to statistical equilibrium (Saha) calculations using emission absorption-measured flame temperatures and neutral seed atom number seed atom nuclear densities. The electron collision frequencies were measured by transmission measurements. Combining these two measurements gave measured electron conductivities of between 4 and 12 mohs/m. These results compared reasonably well with those found with an electron collision frequency model combined with chemical equilibrium calculations and the emission absorption measurements. Ellipticity measurements of electron collision frequency were not possible due to the short path length of the laboratory plasma. 46 refs., 25 figs., 9 tabs.

3003 Thermoelectric Generators

Refer also to citation(s) 6497, 6924

6836 (WHC-SA–1257-Rev.1) **Design and equipment installation for Radioisotope Power Systems Facility metallic cleaning room 162 subsystem 6130: Revision 1.** Adkins, H.E.; Williams, J.A. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 6p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-87RL10930. (CONF-920104–17-Rev.1: 9. symposium on space nuclear power systems, Albuquerque, NM (United States), 13-16 Jan 1992). Order Number DE92002652. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A fully equipped cleaning and packaging line for cleaning nonradioactive metallic components and tools required in the assembly/disassembly of Radioisotope Thermalelectric Generators (RTG) is being designed and installed in room 162 of the Fuels and Materials Examination Facility (FMEF), which contains the Radioisotope Power Systems Facility (RPSF). The FMEF is a modern nuclear facility meeting current safety standards. Process equipment in cleaning room 162 includes a glovebox cleaning station with an airlock, an assembly and packaging workstation, and a downflow spray cleaning station. The glovebox cleaning station is used for controlled atmosphere cleaning of metallic components such as tools and canisters. The assembly and packaging workstation is used for tool and component cleanliness examination, inspection, assembly, and packaging. The downflow spray cleaning table is used for final particulate cleaning and inspection before packaging. The metallic cleaning line is planned for operation in FY as part of the RPSF. 3 figs.

3005 Fuel Cells

Refer also to citation(s) 6551, 6770, 6969, 7084

6837 (DOE/MC/24164–3012) **Characterization and development of a new ceramic electrolyte for fuel cell applications: Final report.** Solid State Fuel Cells, Columbia, MD (United States). Jun 1991. 73p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC21-87MC24164. Order Number DE91002092. Source: OSTI; NTIS; GPO Dep.

This work consisted of research directed toward characterization and development of new solid electrolyte materials that are potentially superior to other solid electrolyte materials currently under development (such as yttria-stabilized zirconia). The solid electrolyte technology described herein is based on new ceramic materials generally described as Bismuth Oxide doped with Niobium or Yyyrium oxides that were exclusively licensed to Solid-State Fuel Cells, Inc. by CeramPhysics, Inc. The technology is also based on further material, cell and stack technology concepts and manufacturing methods that were earlier reduced to practice by Solid- State Fuel Cells, Inc., and which are therefore proprietary to the Company. In this report a presentation of the overall program background is provided in Section 2.0. This includes a technical discussion of the technology in the context of the current state of the art. The task work description for the applicable portion of Phase 1 is presented in Section 3.0. Specifically, Phase 1-A comprises the following elements: Electrolyte materials development; testing of electrolyte stability under a reducing environment; development of cell electrodes; test fixtures design and facility erection; and preliminary coupon cell tests. 24 figs., 6 tabs.

6838 (ETDE-mf–2750133) **Development of high temperature fuel cells - project preparation phase. Final report.** Drenckhahn, W.; Mund, K. Siemens AG Unternehmensbereich KWU, Erlangen (Germany); Bundesministerium fuer Forschung und Technologie, Bonn (Germany). Apr 1991 91p. (In German). Contract BMFT 0328984A. Order Number DE92750133. Source: OSTI; NTIS (US Sales Only).

The basis for the decision whether or not to develop the high temperature fuel cell on a longterm basis, was worked out during the preparation phase. In order to accomplish this task, the molten carbonate fuel cell (MCFC) as well as the solid oxide fuel cell (SOFC, mainly sponsored by the CEC) have been investigated, and power plant studies for both fuel cell technologies were carried out. The MCFC development was performed in cooperation with ISE of the Fraunhofer Society and TH Darmstadt, the system engineering was done in collaboration with Linde AG. The MCFC laboratory cell yielded good power data, but the system studies showed an efficiency advantage of about 10 percent points of the SOFC over the MCFC technology. For this reason, Siemens decided to put more emphasis on the development of the SOFC and discontinue activities regarding the MCFC. (orig.).

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

3201 Buildings

Refer also to citation(s) 7020, 7151

6839 (BNL–46807) **Independent control of sensible and latent cooling: Laboratory testing of a novel control strategy to reduce summer peak loads in residential air conditioning: Final report.** Andrews, J.W.; Piraino, M.; Strasser, J. Brookhaven National Lab., Upton, NY (United States). Sep 1991. 115p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-76CH00016. Order Number DE92005375. Source: OSTI; NTIS; GPO Dep.

A control strategy to reduce peak electric demand in small buildings was tested and evaluated. A test chamber designed to simulate the thermal response of a house was used in the experiments. The control strategy involved precooling the house before the onset of the peak and then controlling on humidity rather than temperature during the peak. A variant of the strategy substituted a low setpoint temperature and a limit on fractional on-time during the peak. Using this variant, the maximum on-peak demand was reduced by 35% while maintaining acceptable thermal comfort. Overall energy consumption was increased by 12%; means for eliminating this excess consumption are suggested for further evaluation.

6840 (CONF-911256–4) **Overview of CFC replacement issues for household refrigeration.** Vineyard, E.A. (Oak Ridge National Lab., TN (United States)); Roke, L.; Hallett, F. Oak Ridge National Lab., TN (United States). [1991]. 7p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From International chlorofluorocarbon (CFC) and halon alternatives conference; Baltimore, MD (United States); 3-5 Dec 1991. Order Number DE92004477. Source: OSTI; NTIS; GPO Dep.

In 1974, the famous ozone depletion theory of Rowland and Molina claimed that chlorofluorocarbons (CFCs) diffuse into the stratosphere where they are broken down by photolysis to release chlorine atoms that catalytically destroy ozone. Although the understanding of the science is still imperfect, there is little doubt that CFCs play a major role in the Antarctic ozone hole phenomenon and the decline in ozone observed in the rest of the world. Another issue that has become increasingly important is the potential of CFCs to change the earth's temperature and to modify the climate. While the main impact in global warming is made by increased concentrations of carbon dioxide, CFCs and other trace gases also contribute to this effect. In an effort to respond to the global environmental threat, a CFC protocol was adopted during a diplomatic conference in Montreal. This document, known as the Montreal Protocol, was ratified in 1988 and put into effect on January 1, 1989. In accordance with Article 6 of the Montreal Protocol, the countries that signed the agreement shall periodically assess the control measures provided for in the Protocol. As part of that assessment process, household refrigeration was investigated to determine the status of CFC-12 replacements. The conclusion was that much progress has been made towards finding a suitable replacement. Compressors designed for HFC-134a have efficiencies comparable to those for CFC-12 and acceptable reliability tests have been obtained with ester lubricants. In addition, other replacements such as R-152a and refrigerant mixtures exist, but will require more study. Cycle options, such as the Stirling cycle, may be viable, but are further out in the future. The impact of new refrigerants is expected to result in elimination of CFC-12 consumption in developed countries by 1997 and in developing countries by 2005.

6841 (CONF-920108–2) **Benchmark performance analysis of an ECM-modulated air-to-air heat pump with a reciprocating compressor.** Rice, C.K. Oak Ridge National Lab., TN (United States). Jan 1992. 40p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From International air conditioning, heating, refrigerating exposition; Anaheim, CA (United States); 25-29 Jan 1992. Order Number DE92004478. Source: OSTI; NTIS; GPO Dep.

A benchmark analysis was conducted to predict the maximum steady- state performance potential of a near-term modulating residential- size heat pump. Continuously variable-speed, permanent-magnet electronically commutated motors (ECMs) were assumed to modulate the compressor and the indoor and outdoor fans in conjunction with existing modulating reciprocating compressor technology. A modulating heat pump design tool was used to optimize this ECM benchmark heat pump, using speed ranges and total heat exchanger sizes per-unit-capacity equivalent to that used by the highest SEER-rated variable-speed unit presently on the market (SEER = 16.4). Parametric steady-state performance optimization was conducted at a nominal design cooling ambient of 95°F (35°C) and at three off-design ambients of 82°F (27.8°C) cooling and 47°F and 17°F (8.3°C and −8.3°C) heating. In comparison to the reference commercially available residential unit, the analysis for the ECM benchmark predicted steady-state heating COPs about 35% higher and a cooling EER almost 25% higher at the nominal design cooling condition. The cooling EER at 82°F (27. 8°C) was 13% higher than that of the reference unit when a comparable sensible heat ratio of 0.71 was maintained, while an EER gain of 24% at the 82°F (27.8°C) rating point was predicted when the sensible heat ratio was relaxed to 0.83. 28 refs., 14 figs., 7 tabs.

6842 (DOE/CH/10093–120) **Refrigeration systems program summary.** Energetics, Inc., Columbia, MD (United States). Dec 1991. 20p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE91015024. Source: OSTI; NTIS; GPO Dep.

In addition to saving energy, deploying advanced refrigeration technologies can substantially benefit the environment. Chlorofluorocarbons (CFCs) have been identified as a major cause of potential global climate change and about 20% of the CFCs consumed by the United States are due to refrigeration systems. As the international Montreal Protocol will phase out CFC compounds no later than 2000, there is tremendous need to develop safe non-CFC refrigerants and working fluids, alternative refrigeration cycles, an non-CFC insulations for appliances. The US Department of Energy (DOE) established the Refrigeration System Program in 1977 to lead a national effort to accelerate the deployment of cost-effective and energy-efficient air-conditioning and refrigeration technologies. The program primarily conducts research and development on advanced refrigeration technologies. The program-managed by the Office of Building Technologies, which reports to DOE's Assistant Secretary for Conversation and Renewable Energy-encompasses several key activities such as investigating alternative refrigerants and refrigeration cycles, developing advanced technologies for future air-conditioning and refrigeration equipment designs, and developing advanced appliance insulations.

6843 (ORNL/TM–11703) **A review of vacuum insulation research and development in the Building Materials Group of the Oak Ridge National Laboratory.** Kollie, T.G.; McElroy, D.L.; Fine, H.A.; Childs, K.W.; Graves, R.S.; Weaver, F.J. Oak Ridge National Lab., TN (United States). Sep 1991. 101p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE92004908. Source: OSTI; NTIS; GPO Dep.

This report is a summary of the development work on flat-vacuum insulation performed by the Building Materials Group (BMG) in the Metals and Ceramics Division of the Oak Ridge National Laboratory (ORNL) during the last two years. A historical review of the technology of vacuum insulation is presented, and the role that ORNL played in this development is documented. The ORNL work in vacuum insulation has been concentrated in Powder-filled Evacuated Panels (PEPs) that have a thermal resistivity over 2.5 times that of insulating foams and seven times that of many batt-type insulations, such as fiberglass. Experimental results of substituting PEPs for chlorofluorocarbon (CFC) foal insulation in Igloo Corporation ice coolers are summarized. This work demonstrated that one-dimensional (1D) heat flow models overestimated the increase in thermal insulation of a foam/PEP-composite insulation, but three-dimensional (3D) models provided by a finite-difference, heat-transfer code (HEATING-7) accurately predicted the resistance of the composites. Edges and corners of the ice coolers were shown to cause the errors in the 1D models as well as shunting of the heat through the foam and around the PEPs. The area of coverage of a PEP in a foam/PEP composite is established as an important parameter in maximizing the resistance of such composites. 50 refs., 27 figs,. 22 tabs.

6844 (PNL–7889) **Measured electric hot water standby and demand loads from Pacific Northwest homes: End-Use Load and Consumer Assessment Program.** Pratt, R.G.; Ross, B.A. Pacific Northwest Lab., Richland, WA (United States). Nov 1991. 116p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC06-76RL01830. Order Number DE92004449. Source: OSTI; NTIS; GPO Dep.

The Bonneville Power Administration began the End-Use Load and Consumer Assessment Program (ELCAP) in 1983 to obtain metered hourly end-use consumption data for a large sample of new and existing residential and commercial buildings in the Pacific Northwest. Loads and load shapes from the first 3 years of data fro each of several ELCAP residential studies representing various segments of the housing population have been summarized by Pratt et al. The analysis reported here uses the ELCAP data to investigate in much greater detail the relationship of key occupant and tank characteristics to the consumption of electricity for water heating. The hourly data collected provides opportunities to understand electricity consumption for heating water and to examine assumptions about water heating that are critical to load forecasting and conservation resource assessments. Specific objectives of this analysis are to: (A) determine the current baseline for standby heat losses by determining the standby heat loss of each hot water tank in the sample, (B) examine key assumptions affecting standby heat losses such as hot water temperatures and tank sizes and locations, (C) estimate, where possible, impacts on standby heat losses by conservation measures such as insulating tank wraps, pipe wraps, anticonvection valves or traps, and insulating bottom boards, (D) estimate the EF-factors used by the federal efficiency standards and the nominal R-values of the tanks in the sample, (E) develop estimates of demand for hot water for each home in the sample by subtracting the standby load from the total hot water load, (F) examine the relationship between the ages and number of occupants and the hot water demand, (G) place the standby and demand components of water heating electricity consumption in perspective with the total hot water load and load shape.

6845 (RAL-91-054) **Dynamic thermal transmission.** Irving, A.D. Rutherford Appleton Lab., Chilton (United Kingdom). Aug 1991. 41p. Order Number DE92750020. Source: OSTI; NTIS (US Sales Only).

The thermal transmittance of a building component may be defined as the amount of heat flux which flows when steady state conditions are maintained across the component. The U-value of the component is a steady state quantity whilst the thermal transmission matrix represents the dynamic response of the component. This work defines the thermal transmission matrix elements in terms of Volterra kernel, or impulse response, functions. The Volterra kernel functions are considered to represent dynamic thermal transmission and the area under each response function may be considered to be equivalent to the steady state value. Linear vector and non-linear univariate thermal systems are considered and discussed with reference to their electrical analogues. The Volterra kernel values are extracted via the time series statistical central moments estimates from the data. (author).

3202 Transportation

Refer also to citation(s) 6854, 6872

6846 (ANL/CP–74752) **Transportation in the twenty-first century.** Coffey, H.T. Argonne National Lab., IL (United States). [1991]. 13p. Sponsored by U.S. Department of Transportation. DOE Contract W-31109-ENG-38. (CONF-9110278–1: Clean air act amendments: an economic opportunity for Illinois and the Midwest, Chicago, IL (United States), 11 Oct 1991). Order Number DE92003521. Source: OSTI; NTIS; GPO Dep.

New energy-efficient and environmentally-sound magnetically levitated (maglev) transportation systems are being developed that have the potential to supplement and extend the intercity portion of our transportation system, and to alleviate part of the commuter congestion on our highways. Prototype passenger-carrying maglev vehicles are now operating in Japan and Germany. The capabilities of these systems, described in science fiction over two decades ago, are no longer speculative. They will be capable of transporting 100–150 passengers per vehicles or 1500 passengers per train at speeds of 250–350 mph. While performing many of the same functions of short-haul aircraft, these electrically powered vehicles: do not emit pollutants along the route; use about 1/3 the energy per passenger mile of modern aircraft; do not contact the guideway and therefore minimize maintenance; are silent except for the noise of air passing over the body. This paper assesses current maglev technology. 7 refs., 5 figs.

6847 (CONF-920153–2) **Variance reduction applied to urban network traffic simulation.** Rathi, A.K. (Oak Ridge National Lab., TN (United States)); Venigalla, M.M. Oak Ridge National Lab., TN (United States). Sep 1991. 31p. Sponsored by U.S. Department of Transportation. DOE Contract AC05-84OR21400. From 71. annual meeting of the Transportation Research Board; Washington, DC (United States); 14 Jan 1992. Order Number DE92004233. Source: OSTI; NTIS; GPO Dep.

This paper describes and illustrates the effectiveness of variance reduction techniques that user can apply to improve the efficiency and reliability of simulation experiments with the TRAF-NETSIM simulation model. The two variance reduction techniques, antithetic variates and common random numbers, reduce the variance of simulation output by replacing the original sampling procedure by a new procedure that yields the same parameter estimate but with a smaller variance. Thus, the user can obtain greater amount of statistical accuracy for the same number of simulation runs. A recent modification in the stochastic sampling process has made the TRAF-NETSIM model amenable to these variance reduction techniques, and allows the user to apply these techniques with minimal additional effort. The effectiveness of these techniques is evaluated through an analysis of simulation output from two TRAF-NETSIM data sets. The estimated values and variances are computed for some representative measures of effectiveness after 10, 20, and 30 replications. The results of this study indicate that both techniques are quite effective in reducing variance of the model output. By using the antithetic variates sampling procedure, the variance of simulation parameter estimates can be reduced by as much as 88 percent. In all cases studied, better statistical precision is obtained by making two-thirds fewer simulations than under conventional multiple replications-based experimentation. The common random number strategy also reduces the variance but is not as effective as the antithetic variates technique in this case study.

6848 (DOE/CE/15348–T8) **Herbert Easterly auxiliary truck heater: Final technical report.** Tennessee Technological Univ., Cookeville, TN (United States). Center for Mfg. Research and Technology Utilization. 9 Dec 1991. 41p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG01-89CE15348. Order Number DE92004434. Source: OSTI; NTIS; GPO Dep.

The objective of this work was to continue the development of the Herbert Easterly heater apparatus for vehicles, such as semi-trailer tractors in order to fully establish its technical feasibility and provide the basis for its commercialization. This heater is auxiliary to the vehicle's primary heating system. With the engine off it heats both the vehicle engine to a temperature at which it starts easily and the vehicle passenger compartment. Specifically, this heater is automatically ignitable, operates directly from the vehicle diesel fuel supply and preheats the vehicle engine fuel prior to combustion. During the course of this work nine different versions of prototype heaters were designed, constructed and tested. All designs were based on the ideas and principles outlined in the Easterly patent. Each successive version incorporated design and fabrication improvements relative to the previous version. The final version, Prototype 9, utilized a multiple water jacket design to capture additional heat from the combustion gases prior to exhausting to the atmosphere. This final prototype exceeded the performance of a commercially available Webasto DBW-2010 using the same commercial burner as the one used in the Webasto unit. The time required to raise the heater fluid temperature by 120°F was 23% less (20 minutes compared to 26 minutes) for Prototype 9 compared to the commercially available unit. In addition a prototype heat exchanger for preheating engine fuel was designed, fabricated and tested. It was also determined that the Prototype 9 auxiliary heater could operate at 85°F for approximately 6 hours on a fully charged 12 volt marine battery rated to deliver 500 cold cranking amps.

6849 (DOE/CE/15449–T8) **Fuel savings in the heavy trucking industry through cool storage: Final report.** Carr, P. Instatherm Co., Cary, NC (United States). 15 Sep 1991. 29p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG01-89CE15449. Order Number DE92000160. Source: OSTI; NTIS; GPO Dep.

Overnight idling wastes considerable amounts of fuel, contributes to noise and air pollution and adds significantly to trucker's operating costs. Costs are increased because of both the fuel wasted and the additional maintenance required on the engine as a result of extended idling. In winter, idling not only allows a resting driver to keep warm but prevents cold weather battery, fuel gelling and engine starting problems. In the summer, however, the only reason for overnight idling is to keep the sleeper compartment habitable for the resting driver and diesel engine idling to accomplish this is a massive overkill. A novel, patented, cool storage system has been developed by the Instatherm Company. This system allows comfortable summer resting conditions for the driver without having to idle the engine or having to start or run any other auxiliary engine. The operating principle is very straightforward – store "cool" from the truck air conditioning system, while the vehicle is driven on the highway and to use this stored "cool" to air condition the sleeper compartment while the driver rests. 17 figs.

3203 Industrial and Agricultural Processes

Refer also to citation(s) 6269, 6401, 6530, 6800, 6844, 7089, 7098, 7481, 7580, 7614

6850 (AFME–88-02-0032) **Study of the effects of pressure and vapour incorporation ratio on the performances of a pelleting machine.** Agence Francaise pour la Maitrise de l'Energie, 75 - Paris (France). 1990. 47p. (In French). Order Number DE92743185. Source: OSTI; NTIS (US Sales Only).

Vapour, in pelleting machine, is used to enhance granulate cohesiveness and machine productivity, reduce power consumption, limit bacteriological activity and reduce the machine wear. In order to optimize the processing costs, vapour feeding have to be specially designed: vapour incorporation mode (distribution line), vapour quantity and vapour pressure. The influences of these factors on the machine performance are described, for various animal foods.

6851 (ANL/CP–72550) **Chemical detoxification of trichloroethylene and 1,1,1-trichloroethane in a microwave discharge plasma reactor at atmospheric pressure.** Krause, T.R.; Helt, J.E. Argonne National Lab., IL (United States). [1991]. 27p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract W-31109-ENG-38. (CONF-911071–5: American Chemical Society symposium on emerging technologies for hazardous waste management, Atlanta, GA (United States), 1-3 Oct 1991). Order Number DE92003997. Source: OSTI; NTIS; GPO Dep.

This report focuses on the application of plasma technology to hazardous waste treatment. Microwave sustained plasmas are used to thermal degrade trichloroethylene and trichloroethane at atmospheric pressure. (JL)

6852 (CONF-910287–7) **Development of a thermal reclamation system for spent blasting abrasive.** Bryan, B.B.; Mensinger, M.C.; Rehmat, A.G. Institute of Gas Technology, Chicago, IL (United States). [1991]. 18p. Sponsored by Institute of Gas Technology. From National research and development conference on the control of hazardous materials; Anaheim, CA (United States); 20-22 Feb 1991. Source: OSTI; Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616.

Abrasive blasting is the most economical method for paint removal from large surface areas such as the hulls and tanks of oceangoing vessels. Tens of thousands of tons of spent abrasive are generated annually by blasting operations in private and US Navy shipyards. Some of this material is classified as hazardous waste, and nearly all of it is currently being either stockpiled or disposed in landfills. The rapid decline in available landfill space and corresponding rise in landfill tipping fees pose a severe problem for shipyard operators throughout the US. This paper discusses the results of a research and development program initiated by the Institute of Gas Technology and supported by the US Navy to develop and test a fluidized-bed thermal reclamation system for spent abrasive waste minimization. Bench- and pilot-scale reclaimer tests and reclaimed abrasive performance tests are described along with the current status of a program to build and test a 5-ton/hour prototype reclaimer at a US Navy shipyard.

6853 (CONF-911256–3) **Modeled performance of non-chlorinated substitutes for CFC-11 and CFC-12 in centrifugal chillers.** Sand, J.R. (Oak Ridge National Lab., TN (United States)); Fischer, S.K.; Joyner, P.A. Oak Ridge National Lab., TN (United States). [1991]. 10p. Sponsored by U.S. DOE Conservation & Renewable Energy; Electric Power Research Institute. DOE Contract AC05-84OR21400. From International chlorofluorocarbon (CFC) and halon alternatives conference; Baltimore, MD (United States); 3-5 Dec 1991. Order Number DE92004350. Source: OSTI; NTIS; GPO Dep.

Current scientific evidence indicates that stratospheric chlorine concentrations below two parts-per-billion will be necessary to reverse and prevent "ozone hole" formations over the Earth's polar regions each spring. This makes it unlikely that HCFC alternatives with non-zero ozone depletion potentials (ODPs), no matter how small, will be accepted as refrigerants or blowing agents for foamed insulations for the long term. Pressure to eventually eliminate all high volume uses of chlorine containing refrigerants provides a strong incentive to find HFC or alternative, chlorine-free compounds with P-V-T characteristics similar to R-11 and R-123 for new and existing large centrifugal chiller applications. Stable chlorine-free compounds with normal boiling points near CFC-11 and HCFC-123 are found in the fluorinated propane or butane or fluorinated ether families. These larger molecules have larger vapor phase heat capacities (Cp), molecular weights, and lower critical temperatures which thermodynamically decrease their volumetric capacity and coefficient of performance in simple cycle applications. Larger molar latent heats of vaporization caused by hydrogen bonding in the ethers may improve their net refrigerating effect over CFC-11 and HCFC-123, however. Consideration was given to the effects of acoustic velocity in the refrigerant, rotational mach numbers, the application of superheat to avoid "wet isentropic compression," and liquid subcooling before isenthalpic expansion. The results indicate that there are several chlorine-free compounds that give modeled chiller performance comparable to CFC-11 and HCF-123 and better that CFC-12 and HFC-134a. Blends of these refrigerants may be required to mitigate the flammability of some of the alternatives which show the best performance, and modifications to the current chiller cycle such as liquid subcooling and suction gas superhead may offer unique advantages for more complicated, larger refrigerant molecules.

6854 (CONF-920307–2) **Waste minimization at fleet operations.** Holmes, T.S. Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (United States). Health Physics Dept. [1991]. 4p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC08-89NV10630. From Waste management '92; Tucson, AZ (United States); 1-5 Mar 1992. Order Number DE92004483. Source: OSTI; NTIS; GPO Dep.

Fleet operations affect our everyday lives in many ways. Goods and services arrive and are provided by fleets both large and small, all over the world. The United States Department of Energy has the largest centrally located federal fleet at the Nevada Test Site (NTS). A fleet this size, over 3500 light, medium and heavy duty vehicles, generates considerable waste in the act of operating and maintaining vital functions. The maintenance facilities totaling over 90,000 square feet of floor space, are equipped to address waste minimization in innovative ways. Through the successful implementation of a comprehensive preventive maintenance program waste minimizing at the Fleet Operations Department have resulted in the elimination of approximately 75,000 gallons of waste that was previously generated.

6855 (DOE/CE–40762T-H4) **Report of the CWRT Workshop on: Waste reduction R&D opportunities in industry: Final report.** Eisenhauer, J. Energetics, Inc., Columbia, MD (United States). Sep 1991. 20p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC01-87CE40762. (CONF-9107193–Summ.: Center for Waste Reduction Technologies (CWRT) workshop on waste reduction R&D opportunities in industry, Arlington, VA (United States), 24 Jul 1991). Order Number DE92004697. Source: OSTI; NTIS; GPO Dep.

The Center for Waste Reduction Technologies conducted a workshop on July 24, 1991 to identify key research and development needed to exploit waste reduction opportunities in industry, with particular emphasis on chemical production and use. The purpose is to move toward a consensus of critical R&D needs that could ultimately by pursued by CWRT, individual companies, or government agencies. The follow general findings emerged from the workshop: The workshop was useful in generating a fairly comprehensive list of major R&D needs for industrial chemical production and use. The six priority R&D areas selected for afternoon discussion addressed key industry needs, but might not reflect a consensus of the top waste reduction priorities. There were other worthy R&D opportunities, particularly some that addressed long-term opportunities, that did not get discussed due to time constraints. The need for better technologies and techniques to separate organics, salts, heavy metals, and other constituents from aqueous solutions seemed to underlie much of the discussion in the afternoon. Some felt that separations technology tended to focus too much on near-term industrial waste problems. However, others felt that even with fundamental changes in industrial processes, separations will continue to be a major technological challenge of industry, particularly with dilute waste streams. The group felt that more work was needed to identify R&D needs as part of the CWRT R&D program. In particular, several participants felt that the six selected R&D areas might not reflect the highest priorities of CWRT members, while others felt that the R&D areas might not reflect the highest priorities of CWRT members, while others felt that the R&D issues needed to be discussed in more depth than was possible in the workshop.

6856 (DOE/CH/10093–87) **Conservation and renewable energy technologies for industry.** National Renewable Energy Lab., Golden, CO (United States). Oct 1991. 20p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE91002107. Source: OSTI; NTIS; GPO Dep.

This publication presents current efforts by the US DOE Office of Industrial Technologies to increase national end-use efficiency and promote renewable energy use in industrial applications. This also entails reducing industrial and municipal waste and the associated environmental impacts and hazards. The transfer of research results to commercial practice in such industries as petroleum refining, chemicals, primary metals, pulp and paper, food, and textiles is a vital step in energy conservation. (GHH)

6857 (DOE/EIA–0552(80-88)) **Changes in energy intensity in the manufacturing sector 1980–1988.** USDOE Energy Information Administration, Washington, DC (United States). Office of Energy Markets and End Use. 16 Dec 1991. 70p. Sponsored by U.S. DOE Energy Information Administration. Order Number DE92004501. Source: OSTI; NTIS; GPO; GPO Dep.

Numerous recent events – the turmoil in the Soviet Union, Iraq's invasion of Kuwait, the 1990 amendments to the Clean Air Act, the December 1989 crisis in heating oil markets, the 20th anniversary of Earth Day, concerns about global climate change, the development of the National Energy Strategy – have refocused America's attention on energy use. Questions are being asked about the quantities and types of energy consumed by various sectors, the purposes for which energy is consumed, and the potential for improved energy efficiency. The Manufacturing Energy Consumptions Survey (MECS), conducted by the Energy Information Administration (EIA), provides background information for addressing many of these questions for the manufacturing sector. The purpose of this report is to begin to examine the changes in energy efficiency from 1980 to 1988. In this report, energy intensity is defined as the ratio of offsite-produced energy consumption per unit of output. Energy consumption is measured in British thermal units (Btu) and output is measured as the constant dollar value of shipments and receipts. A decrease in energy intensity from one period to another corresponds to an increase in energy efficiency, and vice versa.

6858 (DOE/ER/13676–3) **Screening alternative structures for plant control systems: Progress report, October 1, 1988–September 30, 1989.** Douglas, J.M.; Malone, M.F. Massachusetts Univ., Amherst, MA (United States). Dept. of Chemical Engineering. Jan 1990. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER13676. Order Number DE92004314. Source: OSTI; NTIS; GPO Dep.

This report describes progress in the development of a systematic procedure for the screening of chemical process flowsheets using control objectives in combination with economics. Progress in the last year has been in the areas of identification of rules for the screening of steady-state operability in continuous chemical processes and in the development of performance models for complex columns in distillation systems.

6859 (DOE/OSTI–3409/2) **The Office of Industrial Technologies technical reports: A bibliography.** USDOE Office of Scientific and Technical Information, Oak Ridge, TN (United States). Jan 1992. 117p. Sponsored by U.S. DOE Conservation & Renewable Energy. Order Number DE92000497. Source: OSTI; NTIS; GPO Dep.

The US Department of Energy's Office of Industrial Technologies (OIT) conducts R&D activities which focus on the objectives of improving energy efficiency and providing for fuel flexibility within US industry in the area of industrial energy conservation. The Office also conducts programs to reduce waste generation, increase recycling efforts, and improve the use of wastes as process feedstocks. An active program of technology transfer and education supports these activities and encourages adoption of new technologies. To accomplish these objectives OIT cooperates with the private sector to identify its technological needs and to share R&D efforts. R&D is conducted to the point that a new technology is shown to work and that it can be transferred to the private sector end-users. This bibliography contains information on all scientific and technical reports sponsored by the DOE Industrial Energy Conservation Program during the years 1988–1990.

6860 (EGG-M–91314) **Wet oxidation of oil-bearing sulfide wastes.** Miller, R.L.; Hotz, N.J. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1991]. 11p. Sponsored by U.S. Department of Defense. DOE Contract AC07-76ID01570. (CONF-9103213–1: The Minerals, Metals, and Materials Society (TMS) annual meeting, San Diego, CA (United States), 1-5 Mar 1991). Order Number DE92003286. Source: OSTI; NTIS; GPO Dep.

Oil-bearing metal sulfide sludges produced in treatment of an industrial wastewater, which includes plating wastes, have yielded to treatment by electrooxidation and hydrogen peroxide processes. The oxidation can be controlled to be mild enough to avoid decomposition of the organic phase while oxidizing the sulfides to sulfates. The pH is controlled to near neutral conditions where iron, aluminum and chromium(III) precipitate as hydrous oxides. Other metals, such as lead and barium, may be present as sulfate precipitates with limited solubility, while metals such as nickel and cadmium would be present as complexed ions in a sulfate solution. The oxidations were found to proceed smoothly, without vigorous reaction; heat liberation was minimal. 2 refs., 12 figs.

6861 (EGG-M–91315) **Froth flotation of oil-bearing metal sulfide wastes.** Miller, R.L. (Idaho National Engineering Lab., Idaho Falls, ID (United States)); Atwood, R.L.; Ye, Yi. EG and G Idaho, Inc., Idaho Falls, ID (United States). [1991]. 10p. Sponsored by U.S. Department of Defense. DOE Contract AC07-76ID01570. (CONF-920305–2: Minerals, Metals, and Materials Society (TMS) annual meeting and exhibition, San Diego, CA (United States), 1-5 Mar 1992). Order Number DE92003285. Source: OSTI; NTIS; GPO Dep.

An industrial wastewater, including plating wastes, is treated with sodium sulfide and ferrous sulfate to form a sulfide-oxide precipitate containing chromium and other toxic metals. Hydrocarbons, in the water, coat the sulfide-oxide particles, impeding metal recovery. Froth flotation, without reagent addition, was found to recover 93.9% of the solids from the sludge with simultaneous rejection of 89% of the water. Methyl isobutyl carbinol (MIBC) improved recovery and potassium amyl xanthate improved both recovery and grade. The process design has wastewater feed (without MIBC) to the rougher circuit. The rougher concentrate is conditioned with MIBC and fed to a cleaner circuit to achieve a high grade concentrate. About 95% of the water is recirculated to the waste treatment plant. 3 refs., 3 figs., 4 tabs.

6862 (ENEA-RT-AMB--90-35) **Scrapped automobiles and waste tyres: Waste management problematics.** Coronidi, M. ENEA, Casaccia (Italy). Area Energia, Ambiente e Salute. Apr 1991. 35p. (In Italian). (RT/AMB--90-35). Order Number DE92743979. Source: OSTI; NTIS (US Sales Only).

This paper first discusses the environmental protection criteria behind Italian pollution laws relative to scrapped automobile and waste tyres. An assessment is then made of relative present and forecasted waste quantities. The various techniques of wreck recovery and disposal are analyzed and the proposed provisions relevant to the Italian Abruzzo Region are outlined. The production of refuse tyres is discussed together with various techniques of waste tyre recycling. Several options of tyre disposal are described. Particular attention is given to combustion and pyrolysis technologies that allow materials and/or energy recovery.

6863 (KCP--613-4528) **Water-based cleaning fundamentals.** Harding, W.B. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. Dec 1991. 19p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00613. Order Number DE92004881. Source: OSTI; NTIS; GPO Dep.

A basic description of water-based alkaline cleaning is presented, The nature of soils is described. The compositions of conventional cleaning compounds are given with descriptions of the functions of the ingredients. The mechanisms by which soil is removed are explained. The degrees of cleanliness required, along with the influence of the material being cleaned, are discussed. Tests for cleanliness are described.

6864 (KCP--613-4530) **Electromechanical assembly department manufacturing improvements: Final report.** Voss, S.W. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. Dec 1991. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00613. Order Number DE92004792. Source: OSTI; NTIS; GPO Dep.

Techniques for streamlining the processing and flow of products is an electromechanical assembly department were evaluated. Areas looked at included a paperless system for lot identification records, automated tool and fixture storage, evaluation of product transfer methods, and queue time reduction.

6865 (NREL/TP--232-4237) **Wastepaper as a feedstock for ethanol production.** Bergeron, P.W.; Riley, C.J. National Renewable Energy Lab., Golden, CO (United States). Nov 1991. 23p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE92001174. Source: OSTI; NTIS; GPO Dep.

The possibility of using wastepaper as a cheap feedstock for production of ethanol is discussed. As the single largest material category in the municipal solid waste (MSW) stream, wastepaper is the main target of efforts to reduce the volume of MSW. And in the process for producing ethanol from lignocellulosics, the feedstock represents the highest cost. If wastepaper could be obtained cheaply in large enough quantities and if conversion process cost and efficiency prove to be similar to those for wood, the cost of ethanol could be significantly reduced. At the same time, the volume of wastepaper that must be disposed of in landfills could be lessened. 13 refs., 3 figs., 7 tabs.

6866 **Destruction of organic wastes with molten oxidizers.** Bradshaw, R.W.; Holmes, J.T.; Tyner, C.E. To Dept. of Energy. 1990. Filed date 2 Apr 1990. USA Patent patent application 7-502,957. 19p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE92003833. Source: OSTI; NTIS; GPO Dep.

A process for destruction of biologically hazardous organic chemical wastes by using liquefied strongly oxidizing inorganic salts, such as the alkali metal nitrates, at high temperatures and atmospheric pressure, to yield inorganic salts, carbon dioxide, and water. The oxidizing salts are regenerated and recycled.

3206 Municipalities and Community Systems

Refer also to citation(s) 6626, 6824, 6862, 7089, 7580

6867 (CONF-9111137--4-Extd.Abst.) **Assessing demand and supply resources in electric-utility planning.** Hill, L.J. Oak Ridge National Lab., TN (United States). [1991]. 31p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From Western Area Power Administration Conservation and Renewable Energy Program integrated resource planning seminar; Sacramento, CA (United States); 19-20 Nov 1991. Order Number DE92004224. Source: OSTI; NTIS; GPO Dep.

The Western Area Power Administration (WAPA), a federal power marketing agency that transmits federally produced electric power in the Western United States, recently intensified its promotion of integrated resource planning (IRP) for the distribution companies that purchase its power. As part of its promotion, WAPA organized a series of workshops on various aspects of the IRP process. This presentation is part of those workshops. The presentation addresses three topics. The first two provide background: (1) definitions of IRP and demand-side management (DSM) and their historical evolution and (2) IRP as part of a dynamic process, including the motivation for electric utilities to engage in IRP, the IRP process itself, and the implementation and evaluation of DSM programs and supply resources that are selected in the planning process. The body of the presentation addresses the process of integrating DSM and supply resources and two complicating factors in that process. The three methods to integrate DSM and supply resources include: (1) a sequential approach, selecting DSM resources first, then supply resources; (2) a sequential approach, selecting supply resources first, then DSM resources; and (3) a simultaneous approach in which DSM and supply resources are selected together. Current ORNL research on the resource selection biases associated with the three approaches is then discussed. The first complicating factor in integration is accounting for the different dimensions of DSM and supply resources, especially their economic and reliability dimensions. The second factor is determining a cost- or rate-based criterion for selecting resources. Current ORNL research on this topic complements the discussion.

6868 (CRIE-Y--90018) **Planning procedure for public lighting.** Iuchi, M. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)); Yamaoto, K. Central Research Inst. of Electric Power Industry, Tokyo (Japan). Apr 1991. 37p. (In Japanese). Order Number DE92749205. Source: OSTI; NTIS (US Sales Only).

A framework for the planning procedure is proposed to establish plans for lighting a city as a whole including the daily living space for residents to realize affluent national life and achieve well balanced public lighting in urban areas. The consciousness of urban residents to night-time environment comprises agreeableness with beauty and good atmosphere, static acativeness like quietness and composure, and attractiveness including intimacy and joyfulness. A questionnaire survey result reveals that most residents want such lighting be arranged in nearby squares or parks that enables calm and pleasant night-time activities. It is important to establish a lighting plan balanced both in regional and city scales, based on these needs of the residents. Also critical is to select the most effective business system including implementation systems and related organizations, and discuss specific processes in advance, including regulation and guidance of neon sign and signboard installations. 14 refs., 22 figs., 8 tabs.

6869 (DOE/BP--1677) **Commercial sector infrastructure study: Final report, July 23, 1991.** Sparling, S.; Gard, B.; Gordon, F. USDOE Bonneville Power Administration, Portland, OR (United States). Jul 1991. 90p. Sponsored by U.S. DOE Conservation & Renewable Energy. Order Number DE92005359. Source: OSTI; NTIS; GPO Dep.

Achieving greater energy efficiency in the commercial sector requires an infrastructure capable of delivering those savings. The infrastructure is defined as the people and equipment needed to deliver efficiency savings. For example, the infrastructure is made up (in part) of the people skilled in commercial energy analysis available to work at utilities and engineering firms, the distributions who sell energy-efficient equipment, the contractors who install the equipment, and the equipment itself. This report examines the commercial infrastructure in the Bonneville Power Administration region. In June and July 1991 interviews were conducted with utilities, engineering firms, energy service companies, distributors, contractors, installers and manufacturer's reps to assess the current status of the infrastructure. Also, participants were asked to identify any shortages in the labor pool or equipment supply that might occur if the region doubled or tripled the amount of commercial sector conversation activity. Program design issues – such as the amount of money available for rebates or incentives, the types of buildings that are targeted, overall program goals, reporting requirements, etc. – were not addressed in this study.

6870 (KFK–4923) **Experiments towards the stationary and dynamical behavior of the combustion at the incineration research plant TAMARA.** Mittag, K.; Dittrich, H.G. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Datenverarbeitung in der Technik; Kernforschungszentrum Karlsruhe GmbH (Germany). Lab. fuer Isotopentechnik. Sep 1991. 28p. (In German). Order Number DE92750259. Source: OSTI; NTIS (US Sales Only).

The knowledge of the dynamical behavior of the combustion concerning changes in process states is a necessary requirement for an optimal process control of an incineration plant. In this context experiments were run at the incineration research plant TAMARA in which the under-grate-air and the waste streams were changed in steps after sufficiently long stationary operation periods. In addition some experiments were done replacing the waste by wood. The resulting changes in oxygen and carbondioxide concentrations, on combustion and grate temperatures as well as on the length of the grate fire were analysed both for the stationary and for the dynamical behavior. Sudden changes in the under-grate-air causes the combustion state described by oxygen and carbon dioxide concentrations as well as by combustion temperature to move temporarily into a direction opposite to the stationary state. This is caused by a suddenly and temporarily increased or decreased combustion on the grate due to the increased or decreased under-grate-air. In addition the possibilities to use the correlation analysis for process control are demonstrated in determining the time delay between state variables and determining instrument faults. (orig.).

6871 (ORNL/CON–342) **Evaluation of the computerized utilities energy monitoring and control system installed at the US Military Community at Goeppingen, Germany.** Purucker, S.L.; Gettings, M.B. Oak Ridge National Lab., TN (United States). 18 Nov 1991. 58p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE92004600. Source: OSTI; NTIS; GPO Dep.

Under the provisions of an Interagency Agreement between the US Army and the Department of Energy, Martin Marietta Energy Systems, Inc., through the Oak Ridge National Laboratory, is evaluating the Utilities and Energy Monitoring and Control System (UEMCS) installed at the US Military Community Activity at Goeppingen, Germany. This evaluation relies on examination of existing data and information to determine the effectiveness of the UEMCS. The Goeppingen UEMCS is an integral part of a combined UEMCS/district heating system which includes the UEMCS at Schwaebisch Gmuend, Germany. The system was installed during 1985 and 1986. The UEMCS at Goeppingen and Schwaebisch Gmuend are both well designed, implemented, and maintained. The UEMCS is operated in a supervisory mode with distributed intelligence in local controllers. At present, the UEMCS is operated in a supervisory mode with distributed intelligence in local controllers. At present, the UEMCS at Schwaebisch Gmuend does not have a central computer, but requires only a dedicated phone line to couple with the one at Goeppingen. Though the conversion to district heat has produced the majority of energy savings, the UEMCS day/night setback program also contributes substantially, with additional savings from start/stop programs, such as seasonal switchover, and various temperature control programs. Further opportunities for savings exist in increasing monitoring and control of water usage and connecting the community's electrical network to the UEMCS, permitting demand limiting and increased power factor control.

33 ADVANCED PROPULSION SYSTEMS

6872 **Reflector for efficient coupling of a laser beam to air or other fluids.** Kare, J.T. To Dept. of Energy. 1990. Filed date 18 Jul 1990. USA Patent patent application 7-554,728. 27p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE92003824. Source: OSTI; NTIS; GPO Dep.

A reflector array is disclosed herein that provides a controlled region or regions of plasma breakdowns from a laser beam produced at a remotely-based laser source. The plasma may be applied to produce thrust to propel a spacecraft, or to diagnose a laser beam, or to produce shockwaves. The spacecraft propulsion system comprises a reflector array attached to the vehicle. The reflector array comprises a plurality of reflectors spaced apart on a reflective surface, with each reflector acting as an independent focusing mirror. The reflectors are spaced closely together to form a continuous or partially-continuous surface. The reflector array may be formed from a sheet of reflective material, such as copper or aluminum. In operation, a beam of electromagnetic energy, such as a laser beam, is directed at the reflectors which focus the reflected electromagnetic energy at a plurality of regions off the surface. The energy concentrated in the focal region causes a breakdown of the air or other fluids in the focal region, creating a plasma. Electromagnetic energy is absorbed in the plasma and it grows in volume, compressing and heating the adjacent fluid thereby providing thrust. Laser pulses may be applied repetitively. After each such thrust pulse, fresh air can be introduced next to the surface either laterally, or through a perforated surface. If air or some other gas or vapor is supplied, for example from a tank carried on board a vehicle, this invention may also be used to provide thrust in a vacuum environment. 8 figs.

3301 Internal Combustion Engines

Refer also to citation(s) 6255

6873 (CONF-9109230–7) **Fiber-sensor design for turbine engines.** Tobin, K.W. Jr. (Oak Ridge National Lab., TN (United States)); Beshears, D.L.; Turley, W.D.; Lewis, W. III; Noel, B.W. Oak Ridge National Lab., TN (United States). Aug 1991. 10p. Sponsored by U.S. Department of Defense. DOE Contract AC05-84OR21400 ;W-7405-ENG-36. From SPIE meeting; Boston, MA (United States); 3-6 Sep 1991. Order Number DE92003539. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Determination of blade temperatures in the high speed and turbulent environment of a turbine engine is difficult using standard pyrometry techniques because of the presence of high temperature flame and the reflective nature of the inspection surfaces. A technique utilizing thermographic phosphor compounds bonded to engine vanes and turbine blades is presented that mitigates the negative effects of blackbody radiation while potentially allowing near real-time acquisition of blade temperature information. Specialized single and dual fiber-optic probes were designed to interrogate both fixed and rotating surfaces by delivering ultraviolet light from a quadrupled Nd:YAG (266 nm) laser to phosphor coatings consisting of Y_2O_3:Eu, YVO_4:Eu, and YAG:Tb ceramic compound. This technique utilizes the temperature-dependent fluorescent emission of a ceramic phosphor coating to discern the temperature of the interrogated surface. By using these methods, surface temperature measurements to 1200°C are achievable in the combustion environment.

6874 (DOE/ER/12115–1) **The railplug: Development of a new ignitor for internal combustion engines: Annual report, January 16, 1991–January 15, 1992.** Matthew, R.D.; Nichols, S.P.; Weldon, W.F. Texas Univ., Austin, TX (United States). Oct 1991. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-91ER12115. (CONF-9110283–1: Initial studies of a new type of ignitor: the railplug, Toronto, Ontario (Canada), 7-10 Oct 1991). Order Number DE92002578. Source: OSTI; NTIS; GPO Dep.

The goal of the railplug project is to commercialize this miniaturized railgun as an engine technology as rapidly as possible. To improve the technology transfer process, a board of industrial advisors was established. A list of representatives is included at the end of this annual report. The Railplug External Advisory Board (REAB) met in Austin on March 17–18, 1991 to discuss the project plan. A list of comments from the REAB is included at the end of this progress report, along with our written response to those comments. An alternate "first" meeting with some representatives of the REAB was held on July 9, 1991. This meeting was attended by most of the board members who were unable to attend the first meeting. The second meeting of the REAB was held in Toronto, Canada, on October 10, 1991. A list of the board members comments from this meeting is included at the end of this report, along with our written response to those comments. These meetings have proven to be most useful in assuring that this project is conducted as efficiently as possible. The railplug project is essentially divided into three main tasks: (1) Railplug system development; (2) application of railplugs to engines; and (3) railplug durability. The status of each of these tasks is described below.

6875 (DOE/MC/25124–3014) **Conceptual design of coal-fueled diesel system for stationary power applications.** Little (Arthur D.), Inc., Cambridge, MA (United States). May 1989. 314p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC21-88MC25124. Order Number DE91002094. Source: OSTI; NTIS; GPO Dep.

A preliminary conceptual design of a coal-fueled diesel system was prepared as part of a previous systems study. Since then, our team has accumulated extensive results from testing coal-water slurry on the 13-inch bore JS engine (400 rpm) in 1987 and 1988. These results provided new insights into preferred design concepts for engine components. One objective, therefore, was to revise the preliminary design to incorporate these preferred design concepts. In addition there were certain areas where additional, more detailed analysis was required as a result of the previous conceptual design. Another objective, therefore was to perform additional detailed design efforts, such as: (1) market applications and engine sizes, (2) coal-water slurry cleaning and grinding processes, (3) emission controls and hot gas contaminant controls, (4) component durability, (5) cost and performance assessments. (VC)

6876 (DOE/MC/26044–T28) **Wear mechanism and wear prevention in coal-fueled diesel engines: Monthly progress report, 27 April 1990–25 May 1990.** Southwest Research Inst., San Antonio, TX (United States). 20 Jun 1990. 6p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC21-89MC26044. Order Number DE92003473. Source: OSTI; NTIS; GPO Dep.

The overall objective of this program is to develop the diesel engine and lubricant system design approach that has the highest probability for commercial acceptance. Several specific objectives can also be identified. These objectives include: Definition of the dominant wear mechanisms prevailing in coal-fueled diesel engines; Definition of the specific effect of each coal-related lube oil contaminant; Determination of the potential of traditional engine lubrication design approaches to either solve or mitigate the effects of the coal related lube oil contaminants; Evaluation of several different engine design approaches aimed specifically at preventing lube oil contamination or preventing damage due to lube oil contamination; and Presentation of the engine/lubricant system design determined to have the most potential.

6877 (ETDE-mf–2758979) **Investigations on the influence of strongly increased fuel injection pressure on the performance of a direct-injection diesel engine.** Thiesen, U.P. Technische Univ. Braunschweig (Germany). Fakultaet fuer Maschinenbau und Elektrotechnik. 20 Dec 1990 136p. (In German). Order Number DE92758979. Source: OSTI; NTIS (US Sales Only).

It was examined whether a better exhaust gas quality is attainable with a higher injection pressure without negative effects on fuel consumption. General remarks are made at the beginning on the situation of the commercial vehicle diesel engine with regard to future pollutant limiting values. The experimental setup and the testing procedure are described (experimental engine, test stand, varied parameters), and the evaluation method and computation technique for analysis of the measurements are introduced. The cylinder pressure curve was evaluated; the nitrogen oxide emission was computed; a model for the fuel processing and fuel distribution in the combustion chamber was constructed. Results of tests with unchanged injection time are reported, as well as the influence of the injection time, the swirl speed/nozzle hole number and the combustion chamber diameter. Finally it is reported how the parameters of the energy conversion influence fuel consumption and the NO emission. It was found out in total that the high pressure injection is an interesting development objective (improved exhaust gas quality with still acceptable fuel consumption increase). (HWJ).

3303 Electric-Powered Systems

Refer also to citation(s) 6767

6878 (DOE/ID/13074–T1) **Kansas State University Electric Vehicle Site Operator Program: Year 1: First quarter report, July 2, 1991–September 30, 1991.** Hague, J.R.; Steinert, R.A.; Nissen-Pfrang, T. Kansas State Univ., Manhattan, KS (United States). Coll. of Engineering. [1991]. 13p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FC07-91ID13074. Order Number DE92004326. Source: OSTI; NTIS; GPO Dep.

During the past fifteen years Kansas State's faculty has been involved in research of alternative fuel vehicles. From formulation of fuels and automotive fuel storage to development of electronic controls, K-State's faculty research has been ongoing. With the increased awareness of what is occurring to the world's environment, the catalyst – to ensure applied results from faculty research will occur – has been activated. The Department of Energy's Electric Vehicle Site Operator Program is the platform being used to demonstrate international efforts to bring a more acceptable daily mode of transportation to our highways. The first new electrical vehicle procured at K-State in the last ten years, a G-Van, is a technological dinosaur. It does not incorporate leading edge control or drive systems nor does it provide the type of vehicle frame and body to meet a majority of the daily commuter needs required by the American market. Yet, this vehicle represents initial efforts to bring a federally crash certified vehicle to the commercial automotive market. As such, it is an evolutionary step in the mass production of electric vehicle products.

3307 Emission Control

Refer also to citation(s) 7545

6879 **Catalytic converter.** Liber, B. 22 Aug 1991. Filed date 22 Feb 1990. Canada Patent patent application 2010754. 39p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $4.00 CAN; MF $2.75 CAN.

A catalytic converter is provided which is economical to manufacture and is not readily poisoned by contaminants in a gas stream such as would be encountered in the operation of an internal combustion engine, whereby an improved life expectancy of the unit can be achieved. The converter of the invention comprises a sintered porous body including molybdenum or a molybdenum-containing compound or a molybdenum complex. A method of forming a catlytic converter unit comprises forming a slurry including molybdenum or a molybdenum compound, forming the slurry into a sintered body member, and hardening or curing the same to form a self-sustaining body member. A method for treating an exhaust gas using the above catalytic converter is also disclosed. A preferred embodiment for an internal combustion engine is described. Examples of different catalytic compositions are included. 13 figs.

6880 **Microwave diesel scrubber assembly.** Walton, F.B.; Hayward, P.J.; Adams, F.P. 21 Aug 1991. Filed date 21 Feb 1990. Canada Patent patent application 2010546. 24p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $4.00 CAN; MF $2.75 CAN.

A filter assembly for a diesel engine comprises, in combination, a housing defining an exhaust gas passage having an inlet end and an outlet end and a cavity intermediate those two ends and in serial fluid communication with them. The cavity defines an electromagnetically resonant coaxial line waveguide. A filter is disposed within the cavity for removing particulate products of combustion from the exhaust gases passing through the cavity. A mechanism is provided for producing axisymmetrically distributed standing electromagnetic waves within the cavity in order to couple electromagnetic energy in the waves into lossy material in the cavity. In this manner, heat is produced for incinerating the particulates accumulated on the filter, thus regenerating the filter. 6 figs.

3308 Alternative Fuels

Refer also to citation(s) 6607

35 ARMS CONTROL

3501 Policy, Negotiations, and Legislation

6881 (IAEA-INFCIRC--395) **Agreement between the Republic of Argentina and the Federative Republic of Brazil for the exclusively peaceful use of nuclear energy.** International Atomic Energy Agency, Vienna (Austria). 26 Nov 1991. 11p. Order Number DE92614093. Source: OSTI; NTIS (US Sales Only); INIS.

Hard copies are available in English, Portuguese and Spanish from the IAEA Division of Publications, Distribution Unit.

The document reproduces the text of the Agreement between the Republic of Argentina and the Federative Republic of Brazil for the Exclusively Peaceful Use of Nuclear Energy, signed by the Ministers for Foreign Affairs of Argentina and Brazil in Guadalajara, Mexico, on 18 July 1991.

6882 (INIS-mf--13040) **Treaty on the non-proliferation of nuclear weapons: Review conference of the States Parties Geneva 1985.** Disarmament fact sheet. United Nations, New York, NY (USA). Dept. for Disarmament Affairs. Feb 1984 14p. Order Number DE92614094. Source: OSTI; NTIS (US Sales Only); INIS.

Published in the official languages of the United Nations.

The Third Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons will be held in Geneva, Switzerland, in 1985 with a view to assuring that the purposes and provisions of the Treaty are being realized. The Treaty, commonly referred to as the non-proliferation Treaty, is the fundamental instrument to avert the danger of proliferation of nuclear weapons and is, perhaps, the most important multilateral arms regulation agreement of our time. It was negotiated in the 1960s in the Eighteen-Nation Committee on Disarmament in Geneva and in the United Nations General Assembly. The Treaty was opened for signature in London, Moscow and Washington on July 1, 1968. On that date, it was signed by the three Depositary Governments - the Soviet Union, the United Kingdom and the United States - and by 58 other States. As of December 31, 1983 the number of States parties to the Treaty had risen to 119.

6883 (INIS-mf--13041) **The third review conference of the parties to the Treaty on the non-proliferation of nuclear weapons.** Disarmament fact sheet. United Nations, New York, NY (USA). Dept. for Disarmament Affairs. Mar 1985 28p. Order Number DE92614095. Source: OSTI; NTIS (US Sales Only); INIS.

Published in the official languages of the United Nations.

The Third Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons was held in Geneva from 27 August to 21 September 1985, with a view to assuring that the purposes and provisions of the Treaty were being realized. The Conference ended with the adoption by consensus of a Final Declaration, by which the States parties, among other things, solemnly declared their conviction that the Treaty was essential to international peace and security and expressed their support for its objectives. This Fact Sheet provides information on the preparations for the Conference, developments at the Conference and the main features of the Final Declaration. The text of the Treaty is reproduced in Disarmament Fact Sheet No. 33, and its historical background is contained in Fact Sheet No. 41.

6884 (INIS-mf--13045) **Towards the fourth review conference of the Non-Proliferation Treaty in 1990.** Disarmament facts. United Nations, New York, NY (USA). Dept. for Disarmament Affairs. Jul 1989 24p. Order Number DE92614097. Source: OSTI; NTIS (US Sales Only); INIS.

Published in the official languages of the United Nations.

This publication focuses on the background of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), its main provisions and some of the major issues discussed at the three conferences that have thus far been held to review the operation of the Treaty. A fourth conference to review the operation of the Treaty will be held at Geneva from 20 August to 14 September 1990. It will be the last regular review conference before the convening, in 1995, of a conference which will "decide whether the Treaty shall continue in force indefinitely or shall be extended for an additional fixed period or periods" (article X, para.2). A Preparatory Committee (open to all parties) for the Fourth Review Conference has been established by the parties to the NPT, and 95 parties attended the first session, held in New York from 1 to 5 May 1989.

6885 (INIS-mf--13046) **Treaty for the prohibition of nuclear weapons in Latin America (Treaty of Tlatelolco).** Disarmament facts. United Nations, New York, NY (USA). Dept. for Disarmament Affairs. Sep 1989 15p. Order Number DE92614098. Source: OSTI; NTIS (US Sales Only); INIS.

Published in the official languages of the United Nations.

The Treaty of Tlatelolco enhances the security of the countries of the region by reducing the risk of a nuclear-arms race among them, with all the danger and cost that it would entail, and, as a contribution to the world-wide nuclear non-proliferation regime, it constitutes an important confidence-building measure by ensuring, through its control and verification system, that parties to the Treaty do not posses and will not acquire nuclear weapons. List of parties to the Treaty of Tlatelolco as of 31 July 1989: Antigua and Barbuda, Bahamas, Barbados, Bolivia, Brazil (not full party), Chile (not full party), Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Suriname, Trinidad and Tobago, Uruguay and Venezuela. (Argentina and Dominica have signed the Treaty).

6886 (INIS-mf--13083) **A comprehensive nuclear test ban.** Disarmament fact sheet. United Nations, New York, NY (USA). Dept. for Disarmament Affairs. Jan 1985 19p. Order Number DE92615184. Source: OSTI; NTIS (US Sales Only); INIS.

Published in the official languages of the United Nations.

The conclusion of a comprehensive nuclear test ban is of critical importance for the future of arms limitation and disarmament. As the 1980 report of the Secretary-General concluded, a comprehensive nuclear test ban is regarded as the first and most urgent step towards the cessation of the nuclear arms race and, in particular, of its qualitative aspects. It could serve as an important measure for the non-proliferation of nuclear weapons, both vertical and horizontal. It would have a major arms limitation impact in that it would make it difficult, if not impossible, to develop new designs of nuclear weapons and would also place constraints on the modification of existing weapon designs. The permanent cessation of all nuclear-weapon tests has long been sought by the world community and its achievement would be an event of great international significance.

6887 (INIS-mf--13084) **The Non-Proliferation Treaty: Fifteen years after entry into force.** Disarmament fact sheet. United Nations, New York, NY (USA). Dept. for Disarmament Affairs. Jul 1985 15p. Order Number DE92615185. Source: OSTI; NTIS (US Sales Only); INIS.

Published in the official languages of the United Nations.

The need to halt a wider spread of nuclear weapons grew out of the realization that the increase in the number of countries possessing such weapons would increase the threat to world security. As the Treaty on the Non-Proliferation of Nuclear Weapons clearly states in its preamble, the proliferation of nuclear weapons would seriously enhance the danger of nuclear war. The Treaty - also known as the non-proliferation Treaty - was concluded in 1968, at a time when there were already five nuclear-weapon Powers: the United States, the Soviet Union, the United Kingdom, France and China. This fact sheet is intended to provide background material on the Treaty, including the events that led to its conclusion, an overview of its provisions and the developments at the two previously held Review Conferences.

6888 (UCRL-JC-106720) **International defenses against ballistic missile attack: Now, more than ever.** Wood, L. Lawrence Livermore National Lab., CA (United States). 4 Mar 1991. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9102142-1: Defending America in the 1990s, Washington, DC (United States), 20-21 Feb 1991). Order Number DE92003062. Source: OSTI; NTIS; GPO Dep.

This speech, made soon after Desert Storm, presents ideas on the threat of ballistic missiles to the United States. The availability of the missiles to third world countries is discussed. Strong support for the assigned mission of the Strategic Defense Initiative Organization known as Global Protection Against Limited Strikes (GPALS) is made. Also, implications to the ABM treaty are made. (GHH)

3502 Proliferation

Refer also to citation(s) 7537

3503 Verification

Refer also to citation(s) 7388, 7389, 7447, 7519, 7534, 7822

6889 (INIS-mf-13044) **Towards a nuclear-test ban.** Disarmament facts. United Nations, New York, NY (USA). Dept. for Disarmament Affairs. Jun 1989 24p. Order Number DE92614096. Source: OSTI; NTIS (US Sales Only); INIS.

Published in the official languages of the United Nations.

A survey of international efforts from the partial test-ban Treaty (in atmosphere, in outer space and under water) in 1963 to the Soviet-USA negotiations on verification measures for the threshold test-ban Treaty is given. As was the case in the bilateral and trilateral negotiations, the question of adequate verification procedures has remained one of the major problems in the multilateral considerations on a comprehensive test ban. Over the years, a number of proposals have been made in order to solve the issue, in particular by Sweden and by the Soviet Union. In 1988, the four experimental data centres, situated in Canberra, Moscow, Stockholm and Washington, carried out separate and joint experiments in analysis methodology. Communication techniques between the four international data centres and a number of national seismological stations were also tested. In addition, a global data-gathering experiment was conducted, resulting in the creation of an initial research data base at the experimental data centre in Canberra. Further technical experiments are planned for 1989, and in 1990 a large-scale experiment in data exchange and analysis, involving up to a hundred seismological stations globally and lasting several months, is foreseen.

36 MATERIALS

Refer also to citation(s) 7145, 7239

6890 (DOE/ER/45439-1) **University of Illinois at Urbana-Champaign, Materials Research Laboratory progress report for FY 1991.** Illinois Univ., Urbana, IL (United States). Materials Research Lab. Oct 1991. 130p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-91ER45439. Order Number DE92004051. Source: OSTI; NTIS; INIS; GPO Dep.

The Materials Research Laboratory at the University of Illinois is an interdisciplinary laboratory operated in the College of Engineering. Its focus is the science of materials and it supports research in the areas of condensed matter physics, solid state chemistry, and materials science. This report addresses topics such as: an MRL overview; budget; general programmatic and institutional issues; new programs; research summaries for metallurgy, ceramics, solid state physics, and materials chemistry.

6891 (UCRL-53868-90, pp. 4.14-4.18) **Coatings from ions - Modeling and experiments.** Sanders, D.M.; Falabella, S.; Boercker, D.B. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

The authors goal is to provide higher quality coatings to LLNL programs by using ion-based physical vapor deposition technology. Their research efforts have been directed toward achieving higher density, greater purity, improved adhesion, and for ceramic coatings, more precise stoichiometry. To achieve these goals, they have employed both theoretical and experimental research programs. In their experimental efforts, they explored four distinct approaches for making coatings, each of which offers particular advantages for specific applications. These approaches included two types of cathodic arcs, an anodic arc, and an unbalanced magnetron source. In the first phase of their theoretical modeling, they made significant strides in understanding the motion of plasmas in relatively weak magnetic fields. This understanding allowed them to explore a number of experimental approaches that have, in turn, enabled them to refine and validate their theoretical models. The second phase of their theoretical modeling investigated the kinds of coating structures that they can expect to result from condensation of ions which have specific energy distributions. In FY 91, they will compare results from the condensation modeling with the experimental results of the carbon system. They will use this comparison to determine new methods of producing diamond coatings with improved optical transparency for use in protecting infrared windows from abrasion. As in the case of plasma transport modeling, they will use the experimental results to refine and validate the ion condensation models.

3601 Metals and Alloys

Refer also to citation(s) 6194, 6280, 6449, 6451, 6566, 6638, 6639, 6643, 6676, 6727, 6770, 6972, 6973, 6989, 7049, 7061, 7078, 7084, 7110, 7173, 7194, 7195, 7196, 7313, 7532, 7535, 8170, 8322, 8336, 8368, 8369, 8370, 8371, 8429

6892 (ALS/TR-91-027) **Lubrication of fretting joints.** Maillat, M. (Centre National de la Recherche Scientifique (CNRS), 45 - Orleans-la-Source (France). Centre de Recherches sur la Physique des Hautes Temperatures); Hintermann, H.E.; Boving, H.; Kocher, H.R.; Mondin, G. Sandia National Labs., Albuquerque, NM (United States). 1 Oct 1991. 34p. Translation of ESA-CR(P)-1761; N83-34336, January 15, 1983 (pages 64-98 only). Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE92003107. Source: OSTI; NTIS; GPO Dep.

This report discusses the lubrication of different joints subjected to fretting corrosion. Wear of metal-to-metal, and metal-to-ceramic joints is discussed. (JL)

6893 (ANL/CP-73625) **Interdiffusion and grain-boundary migration in Au-Cu bilayers during ion-irradiation.** Alexander, D.E.; Rehn, L.E.; Baldo, P.M. Argonne National Lab., IL (United States). Nov 1991. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-911202-19: Annual fall meeting of the Materials Research Society, Boston, MA (United States), 2-6 Dec 1991). Order Number DE92005238. Source: OSTI; NTIS; INIS; GPO Dep.

Ion irradiation and annealing experiments have been conducted on Au/Cu bilayer films to evaluate the effect of irradiation on diffusion-induced grain boundary migration (DIGM). The Au films were prepared with a large-grained microstructure with grain boundaries perpendicular to the film surface and extending through the film thickness. Irradiations were conducted with 1.5 MeV Kr at 228°C. Rutherford backscattering spectrometry of the samples revealed that interdiffusion was substantially enhanced in the irradiated area relative to the unirradiated area. Both irradiated and annealed-only areas were characterized by a nearly uniform composition of 14 at.% and 7 at.% Cu respectively through the entire thickness of the underlying Au film. Small probe X-ray energy dispersive spectroscopy showed significant lateral compositional homogeneities in both irradiated and annealed areas. These two results are consistent with previous observations of DIGM in the Au/Cu system, suggesting that this previously unexamined mechanism contributes to ion beam mixing.

6894 (ANL/CP–74482) **Small angle neutron scattering from nanometer grain sized materials.** Epperson, J.E.; Siegel, R.W. Argonne National Lab., IL (United States). Nov 1991. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-9111164–2: International workshop on studies of magnetic properties of fine particles and their relevance to materials science, Rome (Italy), 4-8 Nov 1991). Order Number DE92005241. Source: OSTI; NTIS; GPO Dep.

Small angle neutron scattering has been utilized, along with a number of complementary characterization methods suitable to the nanometer size scale, to investigate the structures of cluster-assembled nanophase materials. Results of these investigations are described and problems and opportunities in using small angle scattering for elucidating nanostructures are discussed.

6895 (ANL/CP–74837) **Magnetism of thin film multilayers: An analogue of interacting platelets.** Felcher, G.P.; Huang, Y.Y. Argonne National Lab., IL (United States). Nov 1991. 21p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-9106180–2: NATO Advanced Study Institute conference, Acquafredda di Maratea (Italy), 11-21 Jun 1991). Order Number DE92004129. Source: OSTI; NTIS; GPO Dep.

Progress is being made toward manufacturing materials with magnetic properties tailored to the desired application. This result is reached in several steps, which are monitored with different optical techniques such as polarized neutron reflectometry. First, ferromagnetic, metallic films (of Fe, Co, Ni, Gd), a few nanometers thick, are prepared by vapor deposition. Their magnetization can be tuned by changing the chemistry of thickness of the films, and can be biased by embedding the films into a matrix of antiferromagnetic material. Ensembles of metallic films (multilayers of superlattices) can be created, with a magnetic coupling between adjacent layers regulated by the nature and thickness of the spacer. For increasing spacer thickness, the alignment of neighboring magnetic layers switches between a parallel (F) and an opposite arrangement (AF) in an oscillatory manner. In multilayer structures possessing more than one kind of magnetic atom complex magnetic phase diagrams have been predicted to occur, with properties that are strongly influenced by the presence of a surface. With these characteristics, the phenomenology of magnetic multilayers draws a close similarity to the physics of interacting platelets.

6896 (ANL/CP–74998) **Equilibrium and non-equilibrium metal-ceramic interfaces.** Gao, Y.; Merkle, K.L. Argonne National Lab., IL (United States). [1991]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-911202–17: Annual fall meeting of the Materials Research Society, Boston, MA (United States), 2-6 Dec 1991). Order Number DE92004975. Source: OSTI; NTIS; GPO Dep.

Metal-ceramic interfaces in thermodynamic equilibrium (Au/ZrO$_2$) and non-equilibrium (Au/MgO) have been studied by TEM and HREM. In the Au/ZrO$_2$ system, ZrO$_2$ precipitates formed by internal oxidation of a 7%Zr-Au alloy show a cubic ZrO$_2$ phase. It appears that formation of the cubic ZrO$_2$ is facilitated by alignment with the Au matrix. Most of the ZrO$_2$ precipitates have a perfect cube-on-cube orientation relationship with the Au matrix. The large number of interfacial steps observed in a short-time annealing experiment indicate that the precipitates are formed by the ledge growth mechanism. The lowest interfacial energy is indicated by the dominance of closed-packed [111] Au/ZrO$_2$ interfaces. In the Au/MgO system, composite films with small MgO smoke particles embedded in a Au matrix were prepared by a thin film technique. HREM observations show that most of the Au/MgO interfaces have a strong tendency to maintain a dense lattice structure across the interfaces irrespective of whether the interfaces are incoherent of semi-coherent. This indicates that there may be relatively strong bond between MgO and Au.

6897 (BNL–46846) **Some effects of porosity and HIP'ing on critical currents in internal-tin-processed multifilamentary Nb$_3$Sn wires.** Gregory, E. (IGC/Advanced Superconductors, Inc., Waterbury, CT (United States)); Ozeryansky, G.M.; Suenaga, M. Brookhaven National Lab., Upton, NY (United States). [1991]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-9110306–1: 7. US-Japan workshop on high-field superconductors, Fukuoka (Japan), 21-23 Oct 1991). Order Number DE92005034. Source: OSTI; NTIS; INIS; GPO Dep.

The extent and nature of the porosity developed in both tin-core and tin-ring internal tin NB$_3$Sn materials has been tentatively explored. The porosity was reduced by HIP'ing either after the final heat treatment or at an intermediate state. The J_c in the HIP'd materials appears to be improved at fields below 15 T, but above this field the HIP'd 19 subelement material shows lower J_c's at zero applied strain.

6898 (CONF-910909–13) **Cracking behavior of cored structures.** Wahid, A. (Colorado School of Mines, Golden, CO (United States). Center for Welding and Joining Research); Olson, D.L.; Matlock, D.K.; Kelly, T.J. Colorado School of Mines, Golden, CO (United States). [1991]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER45308. From 1. international conference on heat-resistant materials; Lake Geneva, WI (United States); 22-26 Sep 1991. Order Number DE92005193. Source: OSTI; NTIS; GPO Dep.

The effects of compositional gradients, are considered based on a thermodynamic analysis, referred to as the Cahn-Hillard analysis, which describes the degree to which a local surface energy is modified by the presence of a composition gradient. The analysis predicts that both ductile and brittle fracture mechanisms are enhanced by the presence of a composition gradient. Data on stress corrosion cracking and fatigue crack growth in selected FCC alloys are used to illustrate the significance of microsegregation on mechanical properties.

6899 (CONF-911132–11) **Poly-Si etching using an electron cyclotron resonance microwave plasma sources with multipole confinement.** Gorbatkin, S.M. (Oak Ridge National Lab., TN (United States)); Berry, L.A.; Swyers, J. Oak Ridge National Lab., TN (United States). [1991]. 23p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 38. national symposium of the American Vacuum Society; Seattle, WA (United States); 11-15 Nov 1991. Order Number DE92005114. Source: OSTI; NTIS; GPO Dep.

In this study, mirror field and single coil 2.45 GHz electron cyclotron resonance (ECR) microwave plasma sources were coupled to a multipole, multicusp plasma confinement system, and used to produce chlorine plasmas for poly-Si etching. Scanning Langmuir probes were used to study the effect of process parameters on plasma potentials, plasma density, plasma density uniformity, and electron temperature, while poly-Si etching experiments on 150-mm diam wafers were used to relate process parameters and Langmuir probe results to etch rate, SiO$_2$ selectivity, photo-resist selectivity, and etch uniformity. RF substrate bias at 13.56 MHz was used for ion energy control, and the addition of a third coil below the substrate plane was found useful for fine-tuning the radial plasma uniformity. Undoped poly-Si etch rates >3000 Å/min, Si/SiO$_2$ etch selectivities >25, and 150-mm diam etch uniformities >2% at 1 sigma were obtained but not simultaneously. Tradeoffs in choosing operating conditions for optimum poly-Si etch performance will be discussed.

6900 (CONF-911202–13) **An atom probe field ion microscope investigation of the role of boron in precipitates and at grain boundaries in NiAl.** Jayaram, R.; Miller, M.K. Oak Ridge National Lab., TN (United States). [1991]. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Annual fall meeting of the Materials Research Society; Boston, MA (United States); 2-6 Dec 1991. Order Number DE92005102. Source: OSTI; NTIS; GPO Dep.

The high resolution analytical technique of Atom Probe Field Ion Microscopy (APFIM) has been used to characterize grain boundaries and the matrix of a stoichiometric NiAl alloy doped with 0.04 (100 wppm) and 0.12 at. % (300 wppm) boron. Field ion images revealed boron segregation to the grain boundaries. Atom probe elemental analysis of the grain boundaries measured a boron coverage of up to 30% of a monolayer. Extensive atom probe analyses also revealed a fine dispersion of nanoscale boride precipitates in the matrix. The boron segregation to the grain boundaries was found to correlate with the observed suppression of intergranular fracture. However, the decrease in ductility of boron-doped NiAl is attributed in part of the precipitation hardening effect of the boride phases.

6901 (CONF-911202-15) **Comparison of thermally- and irradiation-induced grain boundary segregation in austenitic stainless steels.** Kenik, E.A. Oak Ridge National Lab., TN (United States). [1991]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Annual fall meeting of the Materials Research Society; Boston, MA (United States); 2-6 Dec 1991. Order Number DE92005172. Source: OSTI; NTIS; GPO Dep.

Segregation at grain boundaries in austenitic stainless steels sensitized by either thermal annealing or irradiation was studied by analytical electron microscopy. Characterization of grain boundary compositions in both types of materials was performed by high spatial resolution ($\geq$ 2 nm) X-ray microanalysis. Whereas similar chromium depletion is observed in both processes, there are differences in the behavior of the other alloying elements and in the mechanisms responsible for the segregation. In thermal sensitization, the nickel/iron ratio and the silicon level observed at grain boundaries are similar to those for the matrix. In cases where little or no precipitation occurs, cosegregation of phosphorus, chromium, and molybdenum occurs at boundaries and interfaces. For radiation sensitization, radiation-induced segregation (RIS) results in enrichment of nickel, silicon, and, in certain cases, phosphorus and in depletion of iron at grain boundaries. There appears to be some synergism between segregation of nickel and silicon, which increases the magnitude of RIS effects. Grain boundary precipitation is often observed in both thermally- and irradiation-sensitized materials. However, the nature and origins of the two types of precipitation are different. The formation of chromium-enriched grain boundary carbides is the cause of the chromium depletion in thermal sensitization. In contrast, the precipitates produced by irradiation are enriched in nickel and silicon and depleted in chromium relative to the matrix and therefore are the result of RIS. Results for thermal- and radiation-induced segregation in manganese-stabilized austenites are compared to that for nickel-stabilized austenites.

6902 (DOE/ER/14135-T1) **An investigation of the effects of history dependent damage in time dependent fracture mechanics, Phase 1, constant load conditions: Progress report.** Brust, F.W.; Krishnaswamy, P.; Ghadiali, N.D. Battelle, Columbus, OH (United States). 14 Nov 1991. 51p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-90ER14135. Order Number DE92004428. Source: OSTI; NTIS; GPO Dep.

In the following section a brief review of constitutive models is presented along with the implications of using them in creep crack growth studies under variable loads. The model searched for this study, is discussed along with is special features that make is particularly suitable for this investigation. This model is based on the creep hardening surface and is particularly useful for variable and fully reversed load histories. In Section 3 an implicit finite element algorithm for this model is derived. Details regarding implementation of this method into FVP and existing FE program to study creep crack growth, are also discussed. The results of the algorithm are verified against closed form solutions for simple geometries in Section 4. Sources of error and differences between using explicit and implicit schemes are also presented. Section 5 compares the numerical results with experimental data for the case of combined tension and torsion and fully reversed load histories. Section 6 provides results of some of the constant load creep crack growth analyses that have been performed to date. Because a wealth of experimental data has been developed for creep crack under constant load conditions, the need to develop our own creep growth data for this study was minimal. Conclusions of the Phase 1 work as well as work planned for the future are discussed in Section 7. Finally, Sections 8 and 9 discuss publications and the Phase 2 effort, respectively. Finally, the implementation of large strain and friction/contact algorithms into the finite element code and the implementation of three additional non-linear constitutive laws and the Walker Model are not discussed here. The large strain algorithm is complete, the endochronic theory is nearly complete, while subroutines for the Bodner and Walker models were obtained from the agencies described above.

6903 (DOE/ER/45095-6) **[Vibrational and electronic properties of clusters and ultrathin films: Annual progress report].** Pennsylvania State Univ., University Park, PA (United States). [1991]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-84ER45095. Order Number DE92005531. Source: OSTI; NTIS; GPO Dep.

Two areas have been focused on in the current period: clusters of Bi grown on surfaces and materials formed from buckyball (C60) clusters.

6904 (DOE/ER/45213-10) **FIM/atom probe study of grain boundaries in Ni_3Al.** Brenner, S.S. Pittsburgh Univ., PA (United States). Dept. of Materials Science and Engineering. [1991]. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-85ER45213. (CONF-9109318-1: Department of Energy-Basic Energy Sciences (DOE-BES) workshop on scientific issues on intermetallic compounds: status and forecast for fundamental research, La Jolla, CA (United States), 11-14 Sep 1991). Order Number DE92004157. Source: OSTI; NTIS; GPO Dep.

Field-ion microscopy and atom probe microanalysis have been used to study grain boundaries in Ni_3Al to help clarify the mechanism by which boron ductilizes this material. Except for the Dartmouth material all of the ductile alloys were grain-refined by cold working and recrystallization at 800–900°C.

6905 (DOE/ER/45213-T2) **Microchemical analysis of intermetallic alloys using the field-ion microscope atom probe: Final report.** Brenner, S.S. Pittsburgh Univ., PA (United States). Dept. of Materials Science and Engineering. 1 Sep 1991. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-85ER45213. Order Number DE92004020. Source: OSTI; NTIS; GPO Dep.

In this final report, we summarize the results of our studies on Ni(sub 3)Al and comment on the future use of field-ion microscopy techniques to elucidate the ductilization effect of boron.

6906 (DOE/ER/45239-7) **Atomic and electronic structure of metals and alloys: Clean surfaces and chemisorbed molecules: Progress report.** State Univ. of New York, Stony Brook, NY (United States). Research Foundation. 26 Nov 1991. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER45239. Order Number DE92005075. Source: OSTI; NTIS; GPO Dep.

The accomplishments of the work done under DOE sponsorship are summarized in the list of publications at the end of this narrative. Here we give a brief description of the nature and the significance of the accomplishments. The activity can be roughly subdivided into three parts: studies of surface alloys, studies of epitaxial ultra-thin films, and studies of electron band structure of metals. The list reflects the developments of particular areas of research and the phasing out of others as this was suggested by the interest in, and the success of, specific experimental projects.

6907 (DOE/ER/45308-5) **Novel concepts in weld metal science: Role of gradients and composite structure: Annual technical progress report, January 1, 1991–December 31, 1991.** Matlock, D.K.; Olson, D.L. Colorado School of Mines, Golden, CO (United States). Center for Welding and Joining Research. Dec 1991. 73p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER45308. Order Number DE92005082. Source: OSTI; NTIS; GPO Dep.

The effects of compositional and microstructural gradients on weld metal properties are being investigated. Crack propagation is solidified alloy structures is being characterized as to solidification orientation and the profile of the compositional variations. The effects of compositional gradients, are considered based on a thermodynamic analysis, referred to as the Cahn-Hillard analysis, which describes the degree to which a local surface energy is modified by the presence of a compositional gradient. The analysis predicts that both ductile and brittle fracture mechanisms are enhanced by the presence of a composition gradient. Special techniques to produce laboratory samples with microstructures which simulate the composition and microstructure gradients in solidified weld metal are used, along with appropriate mathematical models, to evaluate the properties of the composite weld metals. The composite modeling techniques are being applied to describe the effects of compositional and microstructural gradients on weld metal properties in Ni-Cu alloys. The development of metal matrix composition weld deposits on austenitic stainless steels has been studied. The particulate metal matrix composites were produced with ceramic or refractory metal powder filled cored wire, which was gas tungsten arc and gas metal arc welded.

6908 (DOE/ER/45310–35) **Grain boundaries: Progress report, February 15, 1991–October 15, 1991.** Balluffi, R.W.; Bristowe, P.D. Massachusetts Inst. of Tech., Cambridge, MA (United States). Dept. of Materials Science and Engineering. [1991]. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER45310. Order Number DE92004420. Source: OSTI; NTIS; GPO Dep.

The present document is a progress report describing the work accomplished to date during the second year of our four-year grant (February 15, 1990–February 14, 1994) to study grain boundaries. The research was focused on the following three major efforts: Study of the atomic structure of grain boundaries by means of x-ray diffraction, transmission electron microscopy and computer modeling; study of short-circuit diffusion along grain boundaries; and development of a Thin-film Deposition/Bonding Apparatus for the manufacture of high purity bicrystals.

6909 (DOE/ER/45387–T1) **Mechanical properties of materials with nanometer scale microstructures: Progress report, 1 April 1989 to Present.** Nix, W.D. Stanford Univ., CA (United States). Dept. of Materials Science and Engineering. Jul 1991. 22p. Sponsored by U.S. DOE Energy Research. DOE Contract FG03-89ER45387. Order Number DE92004328. Source: OSTI; NTIS; GPO Dep.

For the past two years we have been engaged in a program of research on the mechanical properties of a variety of new materials with nanometer scale microstructures. These materials have been developed recently using vapor phase synthesis techniques and are available in the form of compositionally-modulated (multilayered) thin film materials and ultrafine-grained (nanocrystalline) solids. They have interesting microstructures and mechanical properties that may lead to new applications for these materials. In this report we give a brief summary of some of the results we have obtained to date in the course of this research. Other, more detailed, descriptions of some of this work can be found in the papers that we have published. These are listed at the end of this report along with a listing of the oral presentations we have given. We report briefly on our studies of the elastic properties of metallic multilayered thin films. Using indentation and microbeam deflection techniques, we have found that Au/Ni multilayers do not show supermodulus effects, contrary to some previous reports based on bulge test results. However, we have discovered large and significant substrate interaction stresses in these films which depend systematically on the composition modulation wavelength. We believe that these residual stresses may have led to bulge testing errors which in turn led to erroneous reports of supermodulus effects.

6910 (DOE/ER/75564–7) **Commercialization plan for Argonne's lubricious coatings.** Skackson, R.H. Industrial Technology Inst., Ann Arbor, MI (United States). 14 Mar 1991. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-90ER75564. Order Number DE92005086. Source: OSTI; NTIS; GPO Dep.

This report summarizes an interview conducted with Dr. David S. Grummon, a specialist in ion beam assisted deposition (IBAD) and coatings at Michigan State University, to define the concept and components of an ion beam assisted deposition (IBAD) system; summarizes findings of a literature search conducted to identify prior and current efforts in developing lubricious coatings; and reports on the market potential for Argonne's IBAD lubricious coating process.

6911 (DOE/NE/37963–17) **Deformation induced microstructural and microchemical changes during thermomechanical treatment: FY90 Annual progress report, Ocotber 1, 1989–September 30, 1990.** Atteridge, D.G. (Oregon Graduate Inst. of Science and Technology, Beaverton, OR (United States)); Murr, L.E.; Wood, W.E.; Bruemmer, S.M. Oregon Graduate Inst. of Science and Technology, Beaverton, OR (United States). [1990]. 150p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-86NE37963. Order Number DE92004394. Source: OSTI; NTIS; INIS; GPO Dep.

An important aspect of this program has been the continued study into: the effects of solution annealing (SA) on the subsequent susceptibility of the stainless steel (SS) material to grain boundary chromium depletion (GBCD); the effects of deformation on SA material and on the subsequent susceptibility of the deformed SS material to GBCD; the effects of deformation on isothermally induced GBCD in mill annealed (MA) and SA SS material; and, modeling the effects of deformation on isothermally induced GBCD in MA and SA SS material. An understanding of these subjects are academically important to this program as well as commercially important to the industrial community. This annual report presents an overview of programmatic research to data in these areas.

6912 (DOE/NE/37963–18) **Deformation induced microstructural and microchemical changes during thermomechanical treatment: FY 91 quarterly annual progress report, April 1, 1991–June 30, 1991.** Atteridge, D.G. (Oregon Graduate Inst. of Science and Technology, Beaverton, OR (United States)); Wood, W.E.; Bruemmer, S.M. Oregon Graduate Inst. of Science and Technology, Beaverton, OR (United States). [1991]. 31p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-86NE37963. Order Number DE92004392. Source: OSTI; NTIS; GPO Dep.

This quarter's effort has been directed towards development and assessment of the capability to predict sensitization development, in particular, sensitization development during continuous cooling. Model predictions are first compared to a continuous cooling (plus prestrain) data base developed under Nuclear Regulatory Commission funding. Parallel model development allowed prediction of weld thermal histories, assessment of weld induced sensitization, and prediction of weldment susceptibility to intergranular stress corrosion cracking (IGSCC). It has long been known that IGSCC of austenitic Type 300 Series stainless steels (SS) is directly related to the presence of grain boundary chromium depletion, and that this depletion, also called "sensitization", is caused by the formation of grain boundary chromium carbides/nitrides. Thus is is well documented that susceptibility to IGSCC is caused by a diffusion controlled process. However, quantification of this phenomena is still on active research area, and the research reported herein pertains to the development of a computer-based model capable of predicting IGSCC susceptibility in the heat affected zone (HAZ) of Type 304 and 316 SS girth pipe weldments. Model predictions are based on prediction of chromium depletion at grain boundaries. It is assumed that as grain boundary sensitization increases susceptibility to IGSCC increases. The model predicts levels of sensitization, with susceptibility to IGSCC estimated on a system by system assessment.

6913 (DOE/NE/37963–19) **Deformation induced microstructural and microchemical changes during thermomechanical treatment: Quarterly progress report, October 1, 1990–December 31, 1990.** Atteridge, D.G. (Oregon Graduate Inst. of Science and Technology, Beaverton, OR (United States)); Wood, W.E.; Bruemmer, S.M. Oregon Graduate Inst. of Science and Technology, Beaverton, OR (United States). [1990]. 21p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-86NE37963. Order Number DE92004399. Source: OSTI; NTIS; GPO Dep.

This quarter's effort has been directed towards development and assessment of the capability of predict sensitization development, in particular, sensitization development during continuous cooling. Model predictions are compared to a continuous cooling (plus prestrain) data base developed under Nuclear Regulatory Commission funding. It has long been known that intergranular stress corrosion cracking (IGSCC) of austenitic Type 300 Series stainless steels

(SS) is directly related to the presence of grain boundary chromium depletion, and that this depletion, also called "sensitization," is caused by the formation of grain boundary chromium carbides/nitrides. Thus it is well documented that susceptibility to IGSCC is caused by a diffusion controlled process. However, quantification of this phenomena is still an active research area, and the research reported herein pertains to the development of a computer-based model capable of predicting sensitization evolution as a function of thermo-mechanical history for Types 304 and 316 SS. The ultimate aim of this modeling effort is to be able to predict susceptibility to intergranular stress corrosion which is known to be related to degree of sensitization (DOS).

6914 (DOE/NE/37963–20) **Deformation induced microstructural and microchemical changes during thermomechanical treatment: Quarterly progress report, January 1, 1991–March 31, 1991.** Atteridge, D.G. (Oregon Graduate Inst. of Science and Technology, Beaverton, OR (United States)); Wood, W.E.; Bruemmer, S.M. Oregon Graduate Inst. of Science and Technology, Beaverton, OR (United States). [1991]. 17p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-86NE37963. Order Number DE92004400. Source: OSTI; NTIS; GPO Dep.

This quarter's effort has been directed towards development and assessment of the capability to predict sensitization development, in particular, sensitization development during continuous cooling. Model predictions are compared to a continuous cooling (plus prestrain) data base developed under Nuclear Regulatory Commission funding. It has long been known that intergranular stress corrosion cracking (IGSCC) of austenitic Type 300 Series stainless steels (SS) is directly related to the presence of grain boundary chromium depletion, and that this depletion, also called "sensitization," is caused by the formation of grain boundary chromium carbides/nitrides. Thus it is well documented that susceptibility to IGSCC is caused by a diffusion controlled process. However, quantification of this phenomena is still an active research area, and the research reported herein pertains to the development of a computer-based model capable of predicting sensitization evolution as a function of thermo- mechanical history for Types 304 and 316 SS. The ultimate aim of this modeling effort is to be able to predict susceptibility to intergranular stress corrosion which is known to be related to degree of sensitization (DOS).

6915 (DOE/OR/00033–T460) **Ion beam enhanced adhesion of metal films to sapphire substrates.** Pawel, J.E. Vanderbilt Univ., Nashville, TN (United States). May 1991. 199p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-76OR00033 ;AC05-84OR21400. Order Number DE92004768. Source: OSTI; NTIS; GPO Dep.

The adhesion change of iron films to sapphire implanted with different ion species has been investigated. Because the chromium, iron, and nickel ions have nearly the same mass, slight adjustments in the accelerating voltage have ensured that the ion concentration profiles, cascade damage profiles, ionization damage profiles, recoil distributions, and sputtering are all very similar for each type of implantation. Adhesion processes dependent on these mechanisms should therefore be similar for the three ion species. The adhesion of the implanted films was measured quantitatively by a pull test and qualitatively by a scratch test. In every case, the adhesion was compared with that from as-deposited films. There is an adhesion increase with both iron and chromium implantation. No change was apparent after nickel implantation. 211 refs., 33 figs.,11 tabs.

6916 (ENEA-RT-NUCL–90-26) **Pd-H, Pd-D type system superconductivity.** Sacchetti, N. ENEA, Frascati (Italy). Area Nucleare. Sep 1991. 10p. (In Italian). (RT/NUCL–90-26). Order Number DE92744031. Source: OSTI; NTIS (US Sales Only).

In this review of a well known Pd-H, Pd-D type system phenomenon - even if pure palladium is not superconducting, the introduction of a suitable amount of H or D into the metal induces superconducting transition with a critical temperature of about 16 K in some cases, e.g., Pd-Cu-H - it is suggested that the theoretical interpretation implies that the superconducting state is connected to a strong reduction of the coulomb pseudo-potential in the interior of the system, with a consequent reduction of the coulomb interaction strength. It is also suggested that possible cold fusion processes could be made easier by very low temperatures.

6917 (INIS-BR–2868) **Investigation of the kinetics of γ-2 phase precipitation in highly cold worked FeCo-2%V.** Ferreira, P.I.; Couto, A.A. Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, SP (Brazil). 1990 22p. (In Portuguese). Order Number DE92613395. Source: OSTI; NTIS (US Sales Only); INIS.

Cu-Zn-Al and Cu-Al-Ni alloys with shape memory effect were tested in matrix phase in many temperatures for obtaining couples of points. σA is the tension in which the matrix phase is induced to a new martensitic phase in the testing temperature. The σ x T diagram suggests a straight-line that in its interception with T axis furnishes the M_s temperature of the testing alloy, experimental values are compatibles with the ones in the literature and obtained by DSC. (author).

6918 (INIS-BR–2872) **Study on the hardness mechanisms of a maraging steel without cobalt.** Andrade, A.H.P. de (Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, SP (Brazil)); Padial, A.G.F.; Montagna, L.S.; Monteiro, W.A. Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, SP (Brazil). 1990 1p. (In Portuguese). Order Number DE92613401. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. MARAGING STEELS/mechanical properties; MICROSTRUCTURE; TRANSMISSION ELECTRON MICROSCOPY

6919 (INIS-BR–2873) **Microstructural evolution of a nickel based superalloy.** Monteiro, W.A. (Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, SP (Brazil)); Santos, I.A. dos. Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, SP (Brazil). 1990 2p. Order Number DE92613396. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. NICKEL BASE ALLOYS/heat treatments; NICKEL BASE ALLOYS/microstructure; INTERMETALLIC COMPOUNDS; MICROSTRUCTURE; TRANSMISSION ELECTRON MICROSCOPY

6920 (INIS-BR–2879) **Γ-precipitation for Inconel 718.** Perdigao, M.N.R.V. (Sao Carlos Univ., SP (Brazil). Dept. de Engenharia de Materiais); Balancin, O.; Botta Filho, W.J. Sociedade Brasileira de Microscopia Eletronica, Rio de Janeiro, RJ (Brazil). 1987 2p. (In Portuguese). (CONF-8709513–: Colloquium of the Brazilian Society of Electron Microscopy, Caxambu (Brazil), 11 Sep 1987). Order Number DE92613397. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ALLOY-NI53CR19FE19NB5MO3/heat treatments; ALLOY-NI53CR19FE19NB5MO3; ORTHORHOMBIC LATTICES; TETRAGONAL LATTICES; TRANSMISSION ELECTRON MICROSCOPY

6921 (INIS-mf–13025 vp.) **Historical achievement of plutonium isolation: Dry chemistry and thermodynamics at the Chicago Met Lab (preprint no. IT-01).** Westrum, E.F. Jr. (Michigan Univ., Ann Arbor, MI (United States). Dept. of Chemistry). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. Feb 1991. 685p. (CONF-9102132–: International symposium on radiochemistry and radiation chemistry - plutonium 50, Bombay (India), 4-7 Feb 1991). In *International symposium on radiochemistry and radiation chemistry (Plutonium - 50 years) (held at Bombay during February 4-7, 1991): Preprints volume.* Order Number DE92001334. Source: OSTI; NTIS (US Sales Only); INIS.

Paper deals with the micro-metallurgy of plutonium metal and the isolation of element 9f as a pure metallic phase. The physical and chemical properties, the development of thermodynamics and some anecdotal experiences are noted. (author). 35 refs.

6922 (INIS-SU–290, pp. 96-97) **Behaviour of elastic bodies in pulse and cyclic thermal fields.** Zotov, V.A. (Moskovskij Aviatsionnyj Tekhnologicheskij Inst., Moscow (USSR)). AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe

Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. 3 refs. SOLIDS/thermal fractures; PULSES; SOLIDS; THERMAL SHOCK; THERMAL STRESSES

6923 (IS-M–672) **A non-contaminating method for preparing intra-rare-earth alloys containing volatile and non-volatile metals.** Beaudry, B.J.; Laabs, F.C. Ames Lab., IA (United States). [1991]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. (CONF-920305–1: Minerals, Metals, and Materials Society (TMS) annual meeting and exhibition, San Diego, CA (United States), 1-5 Mar 1992). Order Number DE92000524. Source: OSTI; NTIS; GPO Dep.

The preparation of alloys containing one to two percent of the volatile lanthanide metals Sm, Eu, Tm and Yb in the high melting point (HMP) rare earth metals Sc, Y and Lu was accomplished by a vapor deposition, diffusion method without crucible contamination. The method avoids the melting of the HMP metals which would introduce impurities from the crucible generally Ta or W. Plates of the HMP metals were hung from the lid in the upper part of the Ta crucible. The volatile metals were placed on the bottom and the lid welded in place under an atmosphere of helium. By proper selection of the alloying temperature, the effusion of the metal vapors through the helium atmosphere was slow enough to permit diffusion to occur and prevent refluxing of the newly formed alloy. Very volatile metals such as Mg required a Knudsen cells with a suitably size hole to prevent too rapid transfer of the low melting metal. Electron microprobe analysis of a cross-section of the HMP metals showed a homogeneous distribution of the volatile metals. The time and temperature required to obtain a homogeneous rare earth alloy without contamination are given. The use of the Knudsen cell to form magnesium-rare earth alloys is reviewed. 8 refs., 2 tabs.

6924 (IS-M–676) **Resistivity changes and grain growth with time at elevated temperatures of n-type $Si_{80}Ge_{20}$ with and without GaP and of p-type $Si_{80}Ge_{20}$ alloys.** Tschetter, M.J.; Beaudry, B.J. Ames Lab., IA (United States). 18 Oct 1991. 9p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-7405-ENG-82. (CONF-920104–22: 9. symposium on space nuclear power systems, Albuquerque, NM (United States), 13-16 Jan 1992). Order Number DE92004648. Source: OSTI; NTIS (US Sales Only); GPO Dep.

$Si_{80}Ge_{20}$ alloys containing GaP and P prepared for use in the modular isotopic thermoelectric generator (MOD-RTG) have been monitored continuously for resistivity changes at elevated temperatures for up to three years. Changes in resistivity with time due to dopant precipitation have been considerably slower at 400°C and 500°C than alloys without GaP added. At 600°C and above, changes in resistivity with time are higher in alloys with GaP. Changes in resistivity of p-type $Si_{80}Ge_{20}$ alloys at the same temperatures agree very well with those reported in the literature. Effects of GaP on grain growth of n-type Si-Ge alloys were also studied at heat treatment temperatures of 1050, 1100 and 1150°C.

6925 (IS-T–1566) **Strength, ultrasonic and metallurgical evaluation of diffusion bonds of dissimilar materials.** Ojard, G.C. Ames Lab., IA (United States). 20 Dec 1991. 150p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. Order Number DE92005095. Source: OSTI; NTIS; INIS; GPO Dep.

Diffusion bonding is a well known metallurgical joining technique which allows materials to be bonded together to near net shape. Diffusion bonds between dissimilar materials are of unique interest due to the complex interactions at the bond line. Previous experimental work has shown that the bond strength is dependent on the extent of interdiffusion between the two base materials. A systematic investigation of diffusion bonding between Cu and Ni was undertaken to study these effects and to find a means of evaluating the bond quality nondestructively. This system was chosen as it exhibits complete solid solubility which yields the simplest metallurgical system of diffusion bonds between dissimilar materials. A large body of work exists on modelling the kinetics of diffusion bonding between similar materials to predict the time for elimination of voids at the bond line. While most bonding conditions, for similar materials, follow the power law creep model, this is not the case for the Cu-Ni system studied. Ultrasonically, the challenge is to measure the extent and uniformity of the interdiffusion layer. Reflection coefficient measurements have been shown not to be sensitive enough to differentiate the samples. A total energy analysis has been shown to be able to differentiate the quality of the Cu-Ni diffusion bonds produced. Thus, this type of analysis appears to be a versatile NDE technique to monitor bond quality in diffusion bonds between dissimilar materials.

6926 (IS-T–1587) **Theoretical studies of amorphous silicon and hydrogenated amorphous silicon with molecular dynamics simulations.** Kwon, I. Ames Lab., IA (United States). 20 Dec 1991. 102p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. Order Number DE92005093. Source: OSTI; NTIS; GPO Dep.

Amorphous silicon (a-Si) and hydrogenated amorphous silicon (a-Si:H) have been studied with molecular dynamics simulations. The structural, vibrational, and electronic properties of these materials have been studied with computer-generated structural models and compare well with experimental observations. The stability of a-si and a-Si:H have been studied with the aim of understanding microscopic mechanisms underlying light-induced degradation in a-Si:H (the Staebler-Wronski effect). With a view to understanding thin film growth processes, a-Si films have been generated with molecular dynamics simulations by simulating the deposition of Si-clusters on a Si(111) substrate. A new two- and three-body interatomic potential for Si-H interactions has been developed. The structural properties of a-Si:H networks are in good agreement with experimental measurements. The presence of H atoms reduces strain and disorder relative to networks without H.

6927 (IS-T–1588) **Synthesis and characterization of nanocrystalline silicide compounds.** Karen, B. Ames Lab., IA (United States). 3 Jan 1992. 59p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. Order Number DE92005364. Source: OSTI; NTIS; GPO Dep.

This thesis involves the investigation into the production of nanocrystalline silicide compounds by radio frequency inductively coupled plasma (RF-ICP) and mechanical milling. A system constructed which utilized a RF-ICP, a powder feed system and a condensation /collection chamber to produce nanocrystalline materials. Several silicides, such as Ti_5Si_3, Cr_3Si and $MoSi_2$, were fed into the plasma were they vaporized. The vaporized material then passed into a connecting chamber, where it condensed out of the vapor phase and the resulting powder was collected. Much of the work conducted was in designing and building of the systems components. This was followed by establishing the plasmas operating parameters. The material collected from the ICP chamber was then compared to material produced by mechanical milling. The material produced by both methods were characterized by x-ray diffraction, scanning and transmission-electron microscopy, and energy dispersive spectroscopy. The results indicate that it is possible to produce nanocrystalline material by mechanical milling; however, there is a significant amount of contamination from the milling ball and milling container. The results also show that the Ti_5Si_3 and Cr_3Si compounds can be produced in nanocrystalline form by the ICP method. The resultant material collected from the ICP chamber following the $MoSi_2$ run consisted of nanocrystalline Si and crystalline, Mo rich Si compound. Inductively coupled plasma - atomic emission spectroscopy (ICP-AES) was also used to observe the powders as they passed through the plasma. The resulting data indicates that each compound was vaporized and dissociated in the plasma. The following thesis describes the apparatus and experimental procedure used in producing nanocrystals.

6928 (JAERI-M–91-116) **Effect of minor elements on hot workability of Ni-Cr-W superalloys.** Tsuji, Hirokazu (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Nakajima, Hajime; Shimizu, Tetsuya; Isobe, Susumu. Japan Atomic Energy Research Inst., Tokyo (Japan). Aug 1991. 28p. (In Japanese). Order Number DE92750951. Source: OSTI; NTIS (US Sales Only); INIS.

Research and development have been carried out on the new Ni-Cr-W superalloys as a component material for HTGRs with coolant outlet temperatures of around 1000degC. The basic composition, Ni- 18 to 19 mass% Cr- 20 to 22 mass% W, of the experimental alloys was specified in the first step. Applying this new alloy to reactor components, the alloy with stable qualities should be supplied in an industrial scale. From such a viewpoint, the hot workability is one of the most important indices. Thus, in order to examine the effect of addition of Mn, Si, B, Y, Ti, etc. on the hot workability, a series of high-strain-rate high-temperature tension tests, so-called Gleeble tests, was carried out on 21 heats of Ni - 18 to 19 mass% Cr - 20 to 22 mass% W alloys at temperatures ranging from 800 to 1300degC at every 50degC for most of the heats, and also at 500, 600 and 700degC for the other heats. Based on the results obtained the following conclusions are drawn: (1) The addition of Mn and Si was extremely harmful to the hot workability. (2) The addition of B was effective to improve the hot workability. (3) The addition of Y was extremely effective to improve the hot workability. The saturation point of the effectiveness was higher than 0.008 mass%. (4) The addition of Ti was extremely effective to improve the hot workability. Around 0.08 mass% addition of Ti was enough to exhibit the effectiveness. (5) The addition of Nb, Fe and/or the enrichment of C exhibited no beneficial influence in the aspect of the hot workability substantially. (6) A new Ni-Cr-W superalloy, which shows extremely superior hot workability, has been developed. It will be possible that the new alloy is manufactured in an industrial scale. (author).

6929 (JAERI-M–91-132) **Hydrogen absorption by zirconium alloy cladding tube with surface oxide film.** Uchida, Masaaki (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment). Japan Atomic Energy Research Inst., Tokyo (Japan). Aug 1991. 37p. Order Number DE92750962. Source: OSTI; NTIS (US Sales Only); INIS.

Hydrogen absorption kinetics of Zircaloy (2 and 4) and Zr-Nb (1% and 2.5%) cladding tubes were studied by heating in hydrogen gas after oxide film formation in steam, oxygen or air. Hydrogen absorption rate depended on the degree of pre-oxidation. In Zr-Nb, the absorption rate was also sensitive to the atmosphere used for pre-oxidation, whereas in Zircaloy the rate was relatively independent of the kind of oxidant. In all materials, pre-oxidation to the transition point was found to bring about high absorption rate in the subsequent hydriding step. After pre-oxidation to the post-transition region, hydrogen absorption rate by Zircaloy showed constant or slightly decreasing tendency with increasing oxidation level, whereas in Zr-Nb, particularly in Zr-2.5%Nb, the rate showed a clearly decreasing tendency depending on the pre-oxidation atmosphere. Different characteristics of Zircaloy and Zr-Nb can partly be explained in terms of different valencies of alloying elements which influence the lattice defect concentrations in the oxide films. (author).

6930 (JAERI-M–91-136) **Effect of minor elements on corrosion behavior of Ni-Cr-W superalloys in HTGR helium.** Tsuji, Hirokazu (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Suzuki, Tomio; Tsukada, Takashi; Nakajima, Hajime. Japan Atomic Energy Research Inst., Tokyo (Japan). Sep 1991. 50p. (In Japanese). Order Number DE92751006. Source: OSTI; NTIS (US Sales Only); INIS.

Research and development have been carried out on the new Ni-Cr-W superalloys as a component material for HTGRs with coolant outlet temperatures of around 1000degC. The basic composition, Ni-18 to 19 mass% Cr-20 to 22 mass% W, of the experimental alloys was specified in the first step. In order to examine the effect of addition of Mn, Si, B, Y and Ti on corrosion behavior in simulated HTGR helium, corrosion tests were carried out on eight heats of Ni-18 to 19 mass% Cr-20 to 22 mass% W alloys at 950 and 1000degC. Thermal cycles were given at intervals of 100h between room temperature and the each test temperature. The cumulative period of exposure to simulated HTGR helium at the each test temperature was 1000h. Based on the results obtained the following conclusions are drawn: (1) All the Ni-Cr-W alloys tested showed better resistance to general corrosion than Hastelloy XR, and also indicated better stability of the surface oxide film and less susceptibility to intergranular oxidation than the conventional Ni-Cr-W alloys. (2) The addition of Mn and Si showed no advantage. The alloys containing Mn and Si rather showed inferior corrosion resistance in simulated HTGR helium. (3) The addition of B and Y was effective to improve corrosion resistance in simulated HTGR helium. (4) Although the addition of Ti was harmful to corrosion resistance in simulated HTGR helium, around 0.08 mass% addition of Ti did not reduce corrosion resistance in the environment. (5) A new Ni-Cr-W superalloy, which shows extremely superior corrosion resistance to conventional Ni-Cr-W superalloys in simulated HTGR helium, has been developed. (author).

6931 (KAERI-II/RR–13/90) **Basic chemistry for radioactive waste management: Study on the corrosion of materials for radwaste containment.** Eom, Tae Yoon (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Jung, Ki Suk; Choi, In Kyu; Park, Su Gil; Yeon, Jei Won. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Mar 1991. 68p. (In Korean). Order Number DE92614822. Source: OSTI; NTIS (US Sales Only); INIS.

To study the mechanism of the corrosion process and to control the corrosion process in relation to the radwaste management, passive films on the metal surfaces and corrosion of iron, carbon steel, and titanium have been studied. Total charges for passivation, breakdown and repassivation process were measured and compared to understand the characteristics of passive films including the growth rate and the stability of the passive films. The bigger the charges for passivation process, the more metal dissolution and corrosion attack were observed. Increasing the concentration of chloride ions, the rate of coverage of exposed metal became slower and the stability of passive fimes were weakened. Corrosion measurements of iron, carbon steel, and titanium were performed. Iron and carbon steels were proven to become passivated in the carbonate media, but pitting corrosion occurred in the presence of chloride ions. From the impedance data, we conclude that an adsorptive reaction forming $Fe(OH)_2$ occurs in the dissolution of iron and carbon steel. In 0.1 M $NaHC0_3$ solution, iron and carbon steel showed a corrosion rate of 43-61 μm/yr and 18 μm/yr, respectively. In ground water, iron showed a corrosion rate of 5.8μm/yr and carbon steel showed an even smaller corrosion rate (0.27μm/yr). Titanium was passivated in an air-saturated 1 M KCl solution, but depassivated under N_2 saturated solution. However, titanium was passivated in 1 M KCl solution even under N_2 saturation. (Author).

6932 (KAERI/RR–949/90) **A study on the transportation of corrosion products in the steam generators.** Yang, Kyung Rin (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Koo, Je Hyeo; Lee, Eun Hee; Hong, Kwang Bum; Kang, Hee Suck. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1991. 117p. (In Korean). Order Number DE92614823. Source: OSTI; NTIS (US Sales Only); INIS.

PC-based workstation consist of keithley model 500A data acquisition system and high sensitivity analog input module 3 is established for pwr secondary side on-line chemistry monitoring. asyst selected as software package is an integrated software system designed exclusively for scientific and engineering applications. (Author).

6933 (KAERI/RR–970/90) **Studies on the causes of failures in titanium tube condensers of nuclear power plants.** Kim, Uh Chul (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Kim, Joung Soo; Chung, Han Sub; Hwang, Seong Sik; Hur, Do Haeng. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Feb 1991. 70p. (In Korean). Order Number DE92614824. Source: OSTI; NTIS (US Sales Only); INIS.

The amount of hydrogen absorbed in Ti tubes varies as the surface condition of Ti tubes changes. It was observed that the amount of hydrogen absorbed in Ti tubes was highest in as-received and welded specimens, while that could be reduced by oxidizing them to make stable oxide surface film or by pickling them. The results of the experiments done by varing the applied cathodic potentials show that hydrogen content absorbed in Ti tubes increases very sharply at or below the potential of -0.9 V versus SCE, which suggests that critical potential for cathodic protection should be above -0.9 V versus SCE. (Author).

6934 (KAERI/RR–982/90) **A study on nuclear materials by neutron scattering.** Kim, Huhn Jun (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Kim, Yong Che; Chun, Byung Chil; Lee, Chang Hee; Lee, Jeong Soo; Seong, Baek Seok; Shim, Hae Seop; Choi, Byung Hoon; Ho, Jong Wha. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Mar 1991. 70p. (In Korean). Order Number DE92614815. Source: OSTI; NTIS (US Sales Only); INIS.

In order to verify the consistent analysis method of determining the anisotropic physical properties of hexagonal polycrystal materials from the texture which we established in 1989, angular dependent ultrasonic velocities were measured on a thin zircaloy-4 sheet, and compared with the estimations based on the texture measurements performed independently by the neutron diffraction. The relative variations of the experimental ultrasonic velocities of SHO (fundamental horizontally polarized shear mode) and SO (fundamental symmetric Lamb mode) waves in the rolling plane showed maximum 0.13% and 0.35% respectively with respect to the velocities in the rolling direction, suggesting very weak anisotropy and agreed well with the estimations obtained from the texture analysis. In a direct comparison of the elastic constant C66 available from absolute velocity measurement of SHO wave with the estimated value agreement was also retained within an error margin of 0.5%. KAERI has been proceeding with construction of 30 MW Korea Multipurpose Research Reactor(KMRR) with various design features. Therefore several preparatory works for neutron beam experiments and plans for the KMRR experimental facilities and neutron diffractometers have been done to the above continued study. The works include design and fabrication of the optimum coarse collimators for 4 standard beam tubes and 1 cold neutron one, and of the inpile collimator for neutron radiography. Mock-up testing of the rotating shutter and collimator, and its control system was done. (Author).

6935 (KCP–613-4508) **Potentiometric analysis of water soluble cutting fluid-metal combinations.** Kelley, E.E. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. Dec 1991. 57p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00613. Order Number DE92004882. Source: OSTI; NTIS; GPO Dep.

The results of corrosion studies conducted by the University of Kansas under Contract G257763 for Allied-Signal Inc., Kansas City Division (KCD), are given. These potentiometric studies evaluate the corrosivity of two water soluble cutting fluids at varying concentrations on samples of 304 stainless steel, 6061-T6 aluminum, and beryllium copper. This testing serves two purposes: (1) to develop effective test procedures adaptable to existing KCD corrosion measurement equipment for corrosion analysis of cutting fluid-metals combinations, and (2) to understand the relative corrosiveness of the varying water soluble cutting fluids on different metals. The tests used were adapted from the American Society of Testing Materials (ASTM). Future testing will identify polarization techniques for establishing corrosion rates which will be used in evaluating both water soluble cutting fluids and other aqueous solutions used at KCD.

6936 (KFK–4861) **Investigations on the creep-rupture behaviour of the austenitic stainless steel AISI 316 NET. Final report.** Schirra, M. (Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Materialforschung); Heger, S.; Ritter, B.; Rivas, M. de las; Chamero, A. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Materialforschung. Aug 1991. 64p. (In German). Order Number DE92758916. Source: OSTI; NTIS (US Sales Only); INIS.

The report describes the creep-rupture tests carried out with a 17Cr-13Ni-2Mo-steel in the frame of the German-Spanish collaboration (KfK-CIEMAT). The material studied is the austenitic steel AISI 316(L) selected as potential first-wall material for NET (Next European Torus). The test program on base material with a NET specified batch comprises in the temperature range 500-750deg C the rupture-time-range till 40 000 h. The results permit statements on the creep- and creep-rupture behaviour and ductility. Metallographic examinations give informations about the fracture behaviour and demonstrate the complex precipitation behaviour. The results are compared with literature data and own results from two batches of the European Fast-Breeder-Program. (orig.).

6937 (LBL–30693) **HREM imaging of single unit cell carbide precipitates in Pt-C alloys.** Witcomb, M.J. (University of the Witwatersrand, Johannesburg (South Africa). Electron Microscope Unit); Dahmen, U.; O'Keefe, M.A.; Westmacott, K.H. Lawrence Berkeley Lab., CA (United States). Jul 1991. 2p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-910870–24: 49. Electron Microscopy Society of America (EMSA) annual meeting, San Jose, CA (United States), 4-9 Aug 1991). Order Number DE92004320. Source: OSTI; NTIS; GPO Dep.

Dilute Pt-C alloys are prototypical for studying oversize carbide phase precipitation from interstitial solid solution. Earlier studies showed the essential function of quenched-in vacancies in the precipitation process. Vacancies play a dual, volume accommodation and structural role in the transformation by modifying both the habit plane spacing and stacking sequence. It was also shown how the precipitation sequence in interstitial Pt-C alloys is analogous to that in substitutional Al-Cu alloys. Initially a "GP zone" consisting of a monolayer plate of carbon atoms and vacancies forms. Atomic resolution images of the so-called α precipitates have confirmed their structure. During subsequent coarsening of the precipitates, α' platelets form. The single-layer α structure, or GP zone is identical to a $\{100\}$ stacking fault stabilized by an intercalation of carbon. The two-layer α' structure is the first true precipitate phase and has a crystal structure anti-isomorphous with calcium fluoride. In the present contribution, simulated images based on this structure are compared with experimental images obtained at 800kV on the JEOL-1000 ARM. In addition to confirming the proposed precipitate structure, the results show the potential for successful imaging of precipitate structures containing light elements. 4 refs., 3 figs.

6938 (LBL–30729) **Control of texture during vapor deposition of Al on (111) Si.** Thangaraj, N. (Lawrence Berkeley Lab., CA (United States)); Westmacott, K.H.; Dahmen, U.; Reyes-Gasga, J. Lawrence Berkeley Lab., CA (United States). Apr 1991. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-910406–39: Spring meeting of the Materials Research Society (MRS), Anaheim, CA (United States), 29 Apr - 3 may 1991). Order Number DE92004168. Source: OSTI; NTIS; GPO Dep.

The growth of Al on (111) Si single crystal substrates by various techniques usually leads to films with (111) texture, sometimes with a small (100) component. Using X-ray diffraction and electron microscopy, the present study shows that the (100) texture component can be enhanced to the point of forming an oriented (100) continuous tricrystal structure. The formation of this texture is shown to be related the presence of Cu. It is concluded that an understanding of heteroepitaxy must take into account the effect of chemistry in addition to the crystallographic criteria of lattice matching.

6939 **Solder extrusion pressure bonding process and bonded products produced thereby.** Beavis, L.C.; Karnowsky, M.M.; Yost, F.G. To Dept. of Energy. 1990. Filed date 20 Apr 1990. USA Patent patent application 7-511,684. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE92004603. Source: OSTI; NTIS; GPO Dep.

Production of soldiered joints which are highly reliable and capable of surviving 10,000 thermal cycles between about −40°C and 110°C. Process involves interposing a thin layer of a metal solder composition between the metal surfaces of members to be bonded and applying heat and up to about 1000 psi compression pressure to the superposed members, in the presence of a reducing atmosphere, to extrude the major amount of the solder composition, contaminants including fluxing gases and air, from between the members being bonded, to form a very thin, strong intermetallic bonding layer having a thermal expansion tolerant with that of the bonded members.

6940 **A method for joining ceramic shapes.** Rabin, B.H. To Dept. of Energy. 1990. Filed date 26 Jun 1990. USA Patent patent application 7-543,897. 15p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. Order Number DE92003815. Source: OSTI; NTIS; GPO Dep.

The invention is a method for joining shapes of ceramic materials together to form a unitary ceramic structure. In the method of the invention, a mixture of two or more chemical components which will react exothermically is placed between the surfaces to be joined, and the joined shapes heated to a temperature sufficient to initiate the exothermic reaction forming a joining material which acts to bond the shapes together. Reaction materials are chosen which will react exothermically at temperatures below the degradation temperature of the materials to be joined. The process is particularly suited for joining composite materials of the silicon carbide-silicon carbide fiber type.

6941 **Electrochemical polishing of thread fastener test specimens of nickel-chromium iron alloys.** Kephart, A.R. To Dept. of Energy. 1990. Filed date 3 Jul 1990. USA Patent patent application 7-547,370. 17p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC12-76SN00052. Order Number DE92003818. Source: OSTI; NTIS; GPO Dep.

An electrochemical polishing device and method for selective anodic dissolution of the surface of the test specimens comprised, for example, of nickel-chromium-iron alloys, which provides for uniform dissolution at the localized sites to remove metal through the use of a coiled wire electrode (cathode) placed in the immediate proximity of the working, surface resulting in a polished and uniform grain boundary.

6942 (PNL-SA-19782) **Crack-tip chemistry modeling of stage I stress corrosion cracking.** Jones, R.H.; Simonen, E.P. Pacific Northwest Lab., Richland, WA (United States). Oct 1991. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract AC06-76RL01830. (CONF-9110311-1: Parkins symposium on fundamentals, Cincinnati, OH (United States), 20-24 Oct 1991). Order Number DE92004515. Source: OSTI; NTIS; INIS; GPO Dep.

Stage I stress corrosion cracking usually exhibits a very strong K dependence with Paris law exponents of up to 30. 2 Model calculations indicate that the crack velocity in this regime is controlled by transport through a salt film and that the K dependence results from crack opening controlled salt film dissolution. An ionic transport model that accounts for both electromigration through the resistive salt film and Fickian diffusion through the aqueous solution was used for these predictions. Predicted crack growth rates are in excellent agreement with measured values for Ni with P segregated to the grain boundaries and tested in IN H_2SO_4 at +900 mV. This salt film dissolution may be applicable to stage I cracking of other materials.

6943 (PNL-SA-20244) **Sensitization and IGSCC susceptibility prediction in stainless steel pipe weldments.** Atteridge, D.G. (Oregon Graduate Inst. of Science and Technology, Beaverton, OR (United States)); Simmons, J.W.; Li, Ming; Bruemmer, S.M. Pacific Northwest Lab., Richland, WA (United States). Nov 1991. 27p. Sponsored by U.S. DOE Nuclear Energy; Nuclear Regulatory Commission. DOE Contract AC06-76RL01830. (CONF-911179-2: Life prediction of corrodible structures, Kauai, HI (United States), 5-8 Nov 1991). Order Number DE92004509. Source: OSTI; NTIS; INIS; GPO Dep.

An analytical model, based on prediction of chromium depletion, has been developed for predicting thermomechanical effects on austenitic stainless steel intergranular stress corrosion cracking (IGSCC) susceptibility. Model development and validation is based on sensitization development analysis of over 30 Type 316 and 304 stainless steel heats. The data base included analysis of deformation effects on resultant sensitization development. Continuous Cooling sensitization behavior is examined and modelled with and without strain. Gas tungsten are (GTA) girth pipe weldments are also characterized by experimental measurements of heat affected zone (HAZ) temperatures, strains and sensitization during/after each pass; pass by pass thermal histories are also predicted. The model is then used to assess pipe chemistry changes on IGSCC resistance.

6944 (SAND-91-0679C) **Dynamic material properties of refractory materials: Molybdenum.** Furnish, M.D.; Chhabildas, L.C. Sandia National Labs., Albuquerque, NM (United States). [1991]. 12p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-911003-21: Fall meeting of the Minerals, Metals and Materials Society of AIME and Materials Week of the American Society of Metals, Cincinnati, OH (United States), 20-24 Oct 1991). Order Number DE92003577. Source: OSTI; NTIS; GPO Dep.

Recently, techniques have been developed to determine dynamic material properties of refractory metals at strain rates of 10^5 to 10^{10} sec^{-1} and to stresses approaching 250 GPa. Similar techniques have been used to measure the dynamic properties of molybdenum; results are summarized in this paper. These experiments have allowed the determination of pressure and loading rate effects on the dynamic yield strength of molybdenum and its viscoelastic properties, as well as a determination of the Hugoniot, at relatively low stresses. Several combinations of loading and reloading and loading and unloading cycles have been employed, utilizing a compressed gas gun and VISAR diagnostics. Pressure ranges from 6.5 to 15 GPa were investigated with specimen thicknesses ranging from 1.5 to 13 mm. The Hugoniot is consistent with earlier observations at higher pressures. The Hugoniot elastic limit appears to decrease slightly with distance over the stress range reported in this study, although the decrease is of the same order as the uncertainties. Otherwise, waves are observed to be steady. Strengths at the HEL and the Hugoniot state, approximately 1.5 GPa, are within the range observed for lower strain rates of 10^{-3} sec^{-1} to $5 \cdot 10^3$ sec^{-1}, consistent with a thermal activation slip model applicable across a wide range of strain rates. Strain rate behaves as approximately as the fourth power of stress, although it appears to decrease with propagation distance over the specimen thickness range used. 15 refs., 8 figs., 2 tabs.

6945 (SAND-91-1732) **An investigation of gouge initiation in high-velocity sliding contact.** Tachau, R.D.M. Sandia National Labs., Albuquerque, NM (United States). Nov 1991. 125p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE92003944. Source: OSTI; NTIS; GPO Dep.

Surface damage has been observed on the rails of rocket sled tracks and on the barrels of high-velocity guns. The phenomenon is generally referred to as "ongoing". Damage to a stationary surface (guider) is created from the oblique impact of a high-velocity object (slider) moving over its surface. The surface damage (gouge) is typically a shallow crater in the shape of a teardrop with the leading edge characterized by the wider end and a slightly raised lip. For rocket sleds, rail gouging occurs when the sled velocity is greater than 1.5 km/sec; while in guns, barrel gouging occurs when the velocity exceeds 4 km/sec. A model is developed to describe the phenomenon of gouging. An unbalanced slider randomly causes a shallow-angle, oblique impact between the slider and the guider. At sufficiently high velocity, the impact produces a thin, but very hot, layer of soft material at the contact surface. Under the action of a moving load, the soft layer lends itself to an antisymmetric deformation and a gouge is formed when this soft material is over-run by the slider. The model is simulated numerically with a hydrodynamic (CTH) code. The results of the simulations are in good agreement with the observed phenomena. Based on the simulated temperature and pressure profiles at the contact surface, design criteria for gouge mitigation are developed in this study. 45 refs., 29 figs., 1 tab.

6946 (SAND-91-2263C) **Selective deposition of copper on poly(tetrafluoroethylene).** Rye, R.R. (Sandia National Labs., Albuquerque, NM (United States)); Chi, K.M.; Hampden-Smith, M.; Kodas, T.T. Sandia National Labs., Albuquerque, NM (United States). [1991]. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9110301-1: Advanced metallization for ULSI applications conference, Newark, NJ (United States), 7-19 Oct 1991). Order Number DE92003949. Source: OSTI; NTIS; GPO Dep.

An additive three step process has been developed for patterned deposition of Cu onto poly(tetrafluoroethylene) (PTFE). The first step involves patterned irradiation with X-rays or electrons which is thought to cross link the PTFE surface; step two involves chemical etching with the result that only the non-irradiated areas are etched; and step three involves selective chemical vapor deposition (CVD) of Cu onto the etched surface at 200 C using (hexafluoroacetylacetonato)Cu(I) trimethylphosphine ((hfac)Cu(PMe_3)). The non-irradiated areas of the surface are covered by a continuous, dense Cu film with X-ray photoelectron spectra show to contain only surface impurities that are easily removed by a short Ar ion sputter. The irradiated areas show the presence of only C and F, characteristic of PTFE.

6947 (SAND–91-2399C) **A comparison of Whipple shield hypervelocity impact tests to penetration predictors.** Hill, S.A. (National Aeronautics and Space Administration, Huntsville, AL (United States). Marshall Space Flight Center, Structures Division); Chhabildas, L.C.; Hertel, E.S. Sandia National Labs., Albuquerque, NM (United States). [1991]. 4p. Sponsored by U.S. DOE Defense Programs; National Aeronautics and Space Administration. DOE Contract AC04-76DP00789. (CONF-9110217–6: 42. International Aeronautical Federation Congress (IAEFC), Montreal (Canada), 7-11 Oct 1991). Order Number DE92004740. Source: OSTI; NTIS; GPO Dep.

The purpose of this paper is to develop an analytical model to convert ballistic limit curves obtained from flat projectile experiments to ballistic limit curves based on equivalent diameter spheres. Results from a test program involving flat plat projectiles conducted at Sandia National Laboratories are compared against the predicted performance of equivalent spherical projectiles as determined from the Wilkinson and Cour-Palais penetration equations. The developed method demonstrates good correlation of the ballistic limit of the shield concept for the flat plate projectiles to the theoretical ballistic limit for equivalent spheres as predicted by the penetration equations. 3 refs.

6948 (SAND–91-2533C) **Alloy design options for improvement of the thermomechanical fatigue life of solder joints.** Frear, D.R. (Sandia National Labs., Albuquerque, NM (United States)); Jones, W.B.; Morris, J.W. Jr.; Mei, Z. Sandia National Labs., Albuquerque, NM (United States). [1991]. 32p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789 ;AC03-76SF00098. (CONF-911213–20: American Society of Mechanical Engineers (ASME) annual winter meeting, Atlanta, GA (United States), 1-6 Dec 1991). Order Number DE92003954. Source: OSTI; NTIS; GPO Dep.

In this paper we discuss alloy development options to improve the thermomechanical fatigue behavior of eutectic Sn-Pb solder joints. Eutectic Sn-Pb solder joins fail through the development of a heterogeneous coarsened band of recrystallized and coarsened Pb- and Sn-rich phases. Imposed deformation concentrates solely into this thin region, accelerating fatigue failures. To address this problem, solder alloys are currently being developed which improve the fatigue characteristics of eutectic Sn-Pb solder. New alloys must retain wetting and manufacturability characteristics similar to eutectic Sn-Pb in addition to improving fatigue durability. The options we present to improve fatigue life include: creating a fine superplastic microstructure, homogenizing the microstructure with small alloy additions, reinforcing the solder with a carbon composite structure, using dispersed second phase precipitates that break up the solder microstructure, and using replacement alloys for eutectic Sn-Pb.

6949 (SAND–91-2606C) **Fluxless laser soldering for electronic packaging.** Hosking, F.M.; Keicher, D.M. Sandia National Labs., Albuquerque, NM (United States). [1991]. 11p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC04-76DP00789. (CONF-920247–1: National electronics products conference (NEPCON) west, Anaheim, CA (United States), 23-27 Feb 1992). Order Number DE92003958. Source: OSTI; NTIS; GPO Dep.

Conventional soldering typically requires the use of reactive fluxes to promote wetting. The resulting flux residues are removed primarily with halogenated or chlorofluorocarbon (CFC) solvents. With the mandated phaseout of CFCs by the year 2000, there has been a concentrated effort to develop alternative, environmentally compatible manufacturing and cleaning technologies that will satisfy the restrictions placed on CFCs, but still yield high quality product. Sandia National Laboratories is currently evaluating a variety of alternative fluxless soldering technologies which can be applied to electronic packaging. Laser soldering in a controlled atmosphere has shown great potential as an environmentally compatible process. The effects of laser heating with a 100 watt CW Nd:YAG laser, joint design, and base/filler metal reactions on achieving fluxless wetting with good metallurgical bonds were examined. Satisfactory Ni-Au plated Kovar® solder joints were made with 80In-15Pb-5Ag and 63Sn-37Pb (wt. %) solder alloys in a slightly reducing cover gas. Wetting generally increased with increasing laser power, decreasing laser beam spot size, and decreasing part travel speed. The materials and processing interaction effects are identified and discussed.

6950 (SAND–91-2661C) **Analysis of ultrasonic tinning.** Vianco, P.T.; Hosking, F.M. Sandia National Labs., Albuquerque, NM (United States). 22 Nov 1991. 15p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC04-76DP00789. (CONF-920247–2: National electronics products conference (NEPCON) west, Anaheim, CA (United States), 23-27 Feb 1992). Order Number DE92003948. Source: OSTI; NTIS; GPO Dep.

This report describes experiments conducted as part of the initial phase in which the wettability of tin on oxygen-free, high conductivity (OFHC) copper was examined using a "point source" ultrasonic horn.

6951 (SAND–91-2752C) **Wettability analysis of tin-based, lead free solders.** Vianco, P.T.; Hosking, F.M.; Rejent, J.A. Sandia National Labs., Albuquerque, NM (United States). [1992]. 14p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-920247–3: National electronics products conference (NEPCON) west, Anaheim, CA (United States), 23-27 Feb 1992). Order Number DE92004397. Source: OSTI; NTIS; GPO Dep.

The overall program is comprised of two efforts. The first effort studies the wettability of tin-based, lead free solders on two commonly used substrate materials: copper and gold-nickel plated Kovar™. The evaluation is being conducted by the meniscometer/wetting balance technique which uses the contact angle as the primary metric to quantify wettability. Information about the rate of wetting is also obtainable with this test. The second part of the program is comprised of an assessment of the solderability of actual circuit board assemblies (surface mount and through-hole). This report will describe data from the wettability analysis of lead free solders on copper.

6952 (UCRL–53868-90, pp. 4.1-4.8) **Molecular dynamics modeling of indentation and cutting.** Hoover, W.G. (Univ. of California, Davis (United States)); Belak, J.F.; DeGroot, A.J.; Hoover, C.G.; Stowers, I.F. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

The authors are modeling precision machining processes on an atomic scale by combining molecular dynamics simulation methods with the speed and power of new, massively parallel computers. By simulating the response of every atom in a material, they can obtain much more information that can be gathered through continuum simulations and macroscopic measurements. Their two-dimensional workpiece simulations contain more than a million atoms, and accurately predict the behavior of simple metals.

6953 (UCRL–53868-90, pp. 5.1-5.5) **Superplasticity in intermetallic compounds and structural ceramics.** Dalder, E.N.C. (Lawrence Livermore National Lab., CA (United States)); Hiromoto, D.; Cadwell, K.; Mukherjee, A.K.; Jin, P.; Yang, H.; Sakuma, T. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

A better understanding of how intermetallic compounds and ceramics deform superplastically could lead to advanced fabrication processes for producing structural components of these materials to near-net shape. Successful development of such manufacturing processes could lead to widespread use of these materials in severe high-temperature environments. The objectives of this study are (1) to develop a better understanding of the mechanisms of superplastic behavior in a selected intermetallic compound and selected high-temperature ceramics, and (2) to assess how knowledge of these mechanisms could lead to development of advanced manufacturing techniques for these materials.

6954 (UCRL–53868-90, pp. 5.22-5.27) **Modeling superplastic materials.** Lesuer, D.R.; Syn, C.; Cadwell, K.; Mance, S. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

The authors are developing a model to account for the effects of microstructural evolution, including strain-enhanced grain growth and cavitation, on stress-strain behavior and deformation localization, which affect the superplastic behavior of materials. They are also assessing the abilities of two rate-dependent constitutive laws to predict stress-strain behavior when the kinetics of microstructural evolution are considered.

6955 (UCRL–53868-90, pp. 5.28-5.34) **Modeling and experimental measurement of residual stress.** Flower, E.C. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

The accurate, absolute, and nondestructive measurement of residual stress fields within metallic, ceramic, and composite engineering components is a major problem facing engineers. The author's objective has been to determine residual stress through finite-element modeling and with reliable experimental methods. He has previously demonstrated his ability to calculate with the finite-element method and experimentally measure deformation-induced residual stress with neutrons and x rays and by mechanical and ultrasonic techniques. He has concluded that diffraction is the preferred experimental method and that neutron or high-energy radiation can be used to determine residual stress in the bulk or volume of the specimen. Neutron-diffraction experiments were made at the Chalk River Nuclear Laboratory with thermal neutrons on a stainless steel ring specimen and a Zircaloy-2 bent-beam specimen. In October 1990, his stainless steel ring was used in experiments carried out at the Manuel Lujan, Jr. (Los Alamos) Neutron Scattering Center to demonstrate the first use of a pulsed neutron source to make spatially resolved measurements of residual stress. Previously, in March 1989, he carried out experiments at the Stanford Synchrotron Radiation Laboratory, using synchrotron radiation, an intense, highly focused, x-ray tunable radiation source with a wide range of available energies. These experiments were also a first-demonstration using this diffraction source. In collaboration with researchers at the University of California, Berkeley, he successfully demonstrated an ultrasonic method to determine residual stress using longitudinal waves. With researchers at the University of California, Davis, he designed, analyzed, and constructed a prototype triaxial residual stress measurement system that uses high-energy x-ray diffraction.

6956 (UCRL-ID–108330) **Survey of degradation modes of four nickel-chromium-molybdenum alloys.** Gdowski, G.E. (KMI Energy Services, Livermore, CA (United States)). Lawrence Livermore National Lab., CA (United States). Mar 1991. 67p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract W-7405-ENG-48. Order Number DE92004469. Source: OSTI; NTIS; INIS; GPO Dep.

This report examines the degradation modes of four Ni-Cr-Mo alloys under conditions relevant to the Yucca Mountain Site Characterization Project (YMP). The materials considered are Alloys C-276, C-4, C-22, and 625 because they have desirable characteristics for the conceptual design (CD) of the high-level radioactive-waste containers presented in the YMP Site Characterization Plan (SCP). The types of degradation covered in this report are general corrosion; localized corrosion, including pitting and crevice corrosion; stress corrosion cracking in chloride environments; hydrogen embrittlement (HE); and undesirable phase transformations due to a lack of phase stability. Topics not specifically addressed are welding concerns and microbiological corrosion. The four Ni-Cr-Mo alloys have excellent corrosion resistance in chloride environments such as seawater as well as in more aggressive environments. They have significantly better corrosion resistance than the six materials considered for the CD waste container in the YMP SCP. (Those six materials are Types 304L and 3161L stainless steels, Alloy 825, unalloyed copper, Cu(70)-Ni(30), and 7% aluminum bronze.) In seawater, the Ni-Cr-Mo alloys have negligible general corrosion rates and show little evidence of localized corrosion. The four base materials of these alloys are expected to have nearly indistinguishable corrosion resistance in the YMP environments. The strength requirements of the SCP-CD waste container are met by these materials in the annealed condition; in this condition, they are highly resistant to HE. Historically, HE has been noted when these materials have been strengthened (cold-worked) and used in sour gas (H_2S and CO_2) well service – conditions that are not expected for the YMP. Metallurgical phase stability may be a concern under conditions favoring (1) the formation of intermetallics and carbides, and (2) microstructural ordering.

6957 (ZfK–743) **Investigation of high temperature water steam oxidation of ZrNb1.** Boehmert, J. (Zentralinstitut fuer Kernforschung, Rossendorf (Germany)); Linek, J.; Dietrich, M. Zentralinstitut fuer Kernforschung, Rossendorf (Germany). May 1991. 62p. (In German). Order Number DE92758946. Source: OSTI; NTIS (US Sales Only); INIS.

The oxidation behaviour of ZrNb was investigated in the temperature range of 700-1200deg C in water steam atmosphere. Some experiments was carried out with Zircaloy test specimens for comparing. The kinetics of oxidation and weight gain are similar for both materials. There are evident differences in the structure of the oxide scale and of the O-stabilized alpha layer. Also the oxygen distribution within the metal and the solubility of oxygen from each other differ. This leads to a rapid reduction of room-temperature ductility of ZrNb material. A statistical analysis demonstrates, that the experimental results can be described by the kinetic equations developed by Vrtilkova et al. These equations are also applicable to transient oxidation conditions. (orig.).

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Refer also to citation(s) 6194, 6499, 6763, 6892, 6894, 6896, 6902, 6909, 6910, 6916, 6953, 6993, 7014, 7015, 7056, 7063, 7064, 7135, 7189, 8367

6958 (ANL/CP–72939) **The effect of processing parameters during heat treatment of bulk high-$T_c$superconductors.** Cha, Y.S.; Dorris, S.E.; Hull, J.R.; Poeppel, R.B. Argonne National Lab., IL (United States). Apr 1991. 32p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. (CONF-911213–19: American Society of Mechanical Engineers (ASME) annual winter meeting, Atlanta, GA (United States), 1-6 Dec 1991). Order Number DE92004149. Source: OSTI; NTIS; GPO Dep.

Plastic extrusion is a promising method for producing the long lengths of high-$T_c$superconductor that will be necessary to meet many potential applications. A crucial phase of the extrusion method is removal of organic constituents. Incomplete removal can leave residual carbon at grain boundaries, which can adversely affect the superconducting properties, whereas excessively rapid removal of the organics can cause the extruded superconductor to disintegrate completely. In this paper, we analyze the effects of the following aspects of organics removal, as they apply to the firing of extruded $YBa_2Cu_3O_x$ coils: (1) total pressure in the furnace, (2) oxygen flow, (3) heat conduction, and (4) diffusion of volatile components during removal of organics.

6959 (ANL/CP–73450) **Grain boundary microstructure and transport critical current density in $YBa_2Cu_3O_x$.** Shi, Donglu, Gao, Yufei; Biondi, A.C.; Chen, J.G.; Merkle, K.L.; Goretta, K.C. Argonne National Lab., IL (United States). Sep 1991. 10p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract W-31109-ENG-38. Grant DMR88-09854. (CONF-9109102–3: 5. annual conference on superconductivity and applications, Buffalo, NY (United States), 24-26 Sep 1991). Order Number DE92004133. Source: OSTI; NTIS; GPO Dep.

It is proposed that the transport critical current (J_c) density for high-$T_c$thin films, bicrystals, and bulk ceramics is determined by magnetic field penetration into the grain boundaries; the grain orientation may not in all cases be an important factor. The parameter $(\lambda_L/\lambda_J)^2$ can characterize the strength of the grain boundary coupling, which depends mainly on the crystal coherence and the structure of the boundary.

6960 (ANL/CP–73624) **Stability of uranium silicides during high energy ion irradiation.** Birtcher, R.C; Wang, L.M. Argonne National Lab., IL (United States). Nov 1991. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-911202–18: Annual fall meeting of the Materials Research Society, Boston, MA (United States), 2-6 Dec 1991). Order Number DE92005239. Source: OSTI; NTIS; INIS; GPO Dep.

Changes induced by 1.5 MeV Kr ion irradiation of both U_3Si and U_3Si_2 have been followed by in situ transmission electron microscopy. When irradiated at sufficiently low temperatures, both alloys transform from the crystalline to the amorphous state. When irradiated at temperatures above the temperature limit for ion beam amorphization, both compounds disorder with the Martensite twin structure in U_3Si disappearing from view in TEM. Prolonged irradiation of the disordered crystalline phases results in nucleation of small crystallites within the initially large crystal grains. The new crystallites increase in number during continued irradiation until a fine grain structure is formed. Electron diffraction yields a powder-like diffraction pattern that indicates a random alignment of the small crystallites. During a second irradiation at lower temperatures, the small crystallizes retard amorphization. After 2 dpa at high temperatures, the amorphization dose is increased by over twenty times compared to that of initially unirradiated material.

6961 (ANL/CP–74636) **Flux pinning behavior in twin boundaries of single crystal $YBa_2Cu_3O_{7-\delta}$.** Kwok, W.K.; Fleshler, S.; Welp, U.; Vinokur, V.M.; Downey, J.; Crabtree, G.W. Argonne National Lab., IL (United States). Oct 1991. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-911096–4: 4. international symposium on superconductivity, Tokyo (Japan), 14-17 Oct 1991). Order Number DE92004124. Source: OSTI; NTIS; INIS; GPO Dep.

We present magnetoresistance measurements up to H = 6 Tesla using a crossed magnetic field technique to demonstrate pinning by twin boundaries (TB) in $YBa_2Cu_3O_{7-\delta}$. We investigate geometries for H || c || TB, H || ab || TB and for H rotated within a twin boundary plane. We find the critical angle Θ^* for TB pinning to be field dependent and field independent for H || c || TB and H || ab || TB respectively in fields up to 6 Tesla and temperatures near T_c. In addition, we report on the full phase diagram for the onset of TB pinning. The TB pinning onset temperature coincides with the "shoulder" feature observed in the resistive transition in magnetic fields in these crystals.

6962 (ANL/CP–74692) **Flux motion and dissipation in high-temperature superconductors.** Gray, K.E.; Kim, D.H. Argonne National Lab., IL (United States). Aug 1991. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-9108140–2: Phenomenology and applications of high temperature superconductivity, Los Alamos, NM (United States), 22-24 Aug 1991). Order Number DE92004141. Source: OSTI; NTIS; INIS; GPO Dep.

The effects on flux motion and dissipation of interlayer coupling of the Cu-O planes along the c-axis are considered for the high-temperature superconductors (HTS). It is argued that for the highly-anisotropic HTS, the weak interlayer coupling plays a dominant role that can be described by incoherent Josephson tunneling between superconducting Cu-O bi- or tri-layers. In $YBa_2Cu_3O_7$, the layers are strongly coupled, presumably because the conducting Cu-O chains short circuit the Josephson tunneling, so that these effects are weak or missing.

6963 (ANL/CP–74820) **Tunneling in cuprate and bismuthate superconductors.** Zasadzinski, J.F. (Illinois Inst. of Tech., Chicago, IL (United States). Dept. of Physics); Huang, Qiang; Tralshawala, N.; Gray, K.E. Argonne National Lab., IL (United States). Oct 1991. 12p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract W-31109-ENG-38. Grant DMR-8809854. (CONF-9109102–4: 5. annual conference on superconductivity and applications, Buffalo, NY (United States), 24-26 Sep 1991). Order Number DE92004135. Source: OSTI; NTIS; INIS; GPO Dep.

Tunneling measurements using a point-contact technique are reported for the following high temperature superconducting oxides: $Ba_{1-x}K_xBiO_3$(BKBO), $Nd_{2-x}Ce_xCuO_4$(NCCO), $Bi_2Sr_2CaCu_2O_7$(BSCCO) and $Tl_2Ba_2CaCu_2O_x$ (TBCCO). For the bismuthate, BKBO, ideal, S-I-N tunneling characteristics are observed using a Au tip. The normalized conductance is fitted to a BCS density of states and thermal smearing only proving there is no fundamental limitation in BKBO for device applications. For the cuprates, the normalized conductance displays BCS-like characteristics, but with a broadening larger than from thermal smearing. Energy gap values are presented for each material. For BKBO and NCCO the Eliashberg functions, $\alpha^2F(\omega)$, obtained from the tunneling are shown to be in good agreement with neutron scattering results. Proximity effect tunneling studies are reported for Au/BSCCO bilayers and show that the energy gap of BSCCO can be observed through Au layers up to 600 Å thick.

6964 (ANL/CP–74977) **Synthesis of c-oriented $YbBa_2Cu_3O_{7-\delta}$ films on single and polycrystalline substrates by oxidation of liquid alloys.** Luo, J.S. (Argonne National Lab., IL (United States)); Merchant, N.; Maroni, V.A.; Gruen, D.M.; Tani, B.S.; Sandhage, K.H.; Craven, C.A. Argonne National Lab., IL (United States). Nov 1991. 7p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. (CONF-911202–20: Annual fall meeting of the Materials Research Society, Boston, MA (United States), 2-6 Dec 1991). Order Number DE92005189. Source: OSTI; NTIS; INIS; GPO Dep.

Textured superconducting films of $YbBa_2Cu_3O_{7-\delta}$ supported on single and polycrystalline substrates were prepared by oxidation of a liquid precursor alloy. The substrates were coated by dipping them into a molten alloy ($YbBa_2Cu_3$, m.p. ~870°C), withdrawing them from the melt, then oxidizing the adhering liquid alloy layer to the corresponding oxide phase, i.e., $YbBa_2Cu_3O_{7-\delta}$. Samples prepared in this way exhibited a superconducting transition at ~80 K following annealing in pure OP_2 at 500°C. With $SrTiO_3$ (100) and MgO (100) substrates, evidence was seen for the epitaxial growth of $YbBa_2Cu_3O_{7-\delta}$ crystals having their c-axis parallel to the [100] direction of the substrate. For polycrystalline MgO, x-ray diffraction and microstructural examination showed that the high-$T_c$crystallites in the films were also oriented with their c-axis perpendicular to the substrate surface, but the a and b axes directions were randomly oriented rather than epitaxial.

6965 (BNL–46855) **A method of producing high quality oxide and related films on surfaces.** Ruckman, M.W. (Brookhaven National Lab., Upton, NY (United States)); Strongin, M.; Gao, Yongli. Brookhaven National Lab., Upton, NY (United States). [1991]. 12p. Sponsored by U.S. DOE Energy Research; A.P. Sloan Foundation. DOE Contract AC02-76CH00016. (CONF-911231–4: Technology 2001, San Jose, CA (United States), 3-5 Dec 1991). Order Number DE92005048. Source: OSTI; NTIS; GPO Dep.

Aluminum oxide or aluminum nitride films were deposited on MBE grown GaAs(100) using a novel cryogenic-based reactive thin film deposition technique. The process involves the condensation of molecular oxygen, ammonia or other gases normally used for reactive thin film deposition on the substrate before the metal is deposited. The metal vapor is deposited into this layer and reacts with the molecular solid form the desired compound or a precursor than can be thermally decomposed to generate the desired compound. The films produced by this method are free of impurities and the low temperatures can be used to control the film and interfacial structure. The process can be easily integrated with existing MBE-systems and on going research using the same apparatus suggests than photon or electron irradiation could also be used to promote the reactions needed to give the intended material.

6966 (CONF-910908–2) **Microwave sintered silicon nitride ceramics.** Tiegs, T.N.; Kiggans, J.O.; Menchhofer, P.A. Oak Ridge National Lab., TN (United States). [1991]. 6p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From 2. conference of the European Ceramic Society; Augsburg (Germany); 11-14 Sep 1991. Order Number DE92004405. Source: OSTI; NTIS; GPO Dep.

Silicon nitride-based materials are processed using a variety of thermal heating techniques and procedures, such as sintering, reaction-bonding, and annealing. For sintering, typical silicon nitride processing starts with high α-phase Si_3N_4 powders mixed with sintering aids, such as MgO, Y_2O_3, and Al_2O_3. After consolidation of the mixtures into a shape, they are heated in a nitrogen atmosphere to temperatures of 1700 to 1900°C to densify. The sintering temperature is dependent on the type and quantity of sintering additives utilized. Densification of silicon nitride compacts occurs through a number of distinct steps. Microwave heating has the capability for volumetric thermal heating of ceramic materials. Silicon nitride-based materials heat in a microwave field by coupling to the sintering additives or grain boundary phases. Previous studies on microwave processing of silicon nitride have reported improved densification during sintering, accelerated nitridation of silicon, and improved high-temperature mechanical properties with thermal annealing of dense materials. In the present research, microwave-sintered silicon nitride ceramics were examined, and the densification behavior and microstructure development correlated with the mechanical properties.

6967 (CONF-910908–3) **High temperature tensile and fatigue strengths of Si_3N_4.** Liu, K.C.; Stevens, C.O.; Brinkman, C.R. Oak Ridge National Lab., TN (United States). [1991]. 8p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From 2. conference of the European Ceramic Society; Augsburg (Germany); 11-14 Sep 1991. Order Number DE92005170. Source: OSTI; NTIS; GPO Dep.

Uniaxial tensile fracture and cyclic fatigue data are reported for a grade of HIPed Si_3N_4. The tensile strength was found to be sensitive to stressing rate at temperatures above 1000°C, indicating highly viscoplastic processes were in operation. Both tensile fracture strength and fatigue resistance decreased rapidly as temperature was increased from 1200 to 1370°C. Cycling from low stress to high stress levels in intermittent steps was beneficial to high-cycle fatigue strength due to some strengthening mechanism.

6968 (CONF-911202–14) **Distribution and characterization of iron in implanted silicon carbide.** Bentley, J. (Oak Ridge National Lab., TN (United States)); Romana, L.J.; Horton, L.L.; McHargue, C.J. Oak Ridge National Lab., TN (United States). [1991]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Annual fall meeting of the Materials Research Society; Boston, MA (United States); 2-6 Dec 1991. Order Number DE92005126. Source: OSTI; NTIS; INIS; GPO Dep.

Analytical electron microscopy (AEM) and Rutherford backscattering spectroscopy-ion channeling (RBS-C) have been used to characterize single crystal α-silicon carbide implanted at room temperature with 160 keV ^{57}Fe ions to fluences of 1, 3, and 6 $\times 10^{16}$ ions/cm^2. Best correlations among AEM, RBS, and TRIM calculations were obtained assuming a density of the amorphized implanted regions equal to that of crystalline SiC. No iron-rich precipitates or clusters were detected by AEM. Inspection of the electron energy loss fine structure for iron in the implanted specimens suggests that the iron is not metallically-bonded, supporting conclusions from earlier conversion electron Moessbauer spectroscopy (CEMS) studies. In-situ annealing surprisingly resulted in crystallization at 600°C with some redistribution of the implanted iron.

6969 (CONF-9106303–, pp. 128-129) **SiO_2 membranes for H_2 separation in coal gas processing.** Gavalas, G.R. (California Inst. of Tech., Pasadena (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-89PC89765. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objective is to synthesize permselective ceramic membranes by chemical vapor deposition of SiO_2, TiO_2 and other pure or mixed oxides within the walls of porous support tubes, to characterize the membranes by permeability measurements and scanning electron microscopy, and to develop a mathematical model of the chemical vapor deposition. The amorphous oxide membranes (SiO_2, TiO_2) are very selective to hydrogen permeation and are stable at high temperatures. These properties make them applicable to hydrogen production from coal gas for fuel cell power generation or chemical synthesis. One-sided deposition of SiO_2 was carried out successfully to prepare membranes with higher permeation coefficients than previously possible. TiO_2 deposition in the opposing reactants geometry was found to take place over a broad temperature range. A new deposition model was developed that gives good agreement with the measured SiO_2 and TiO_2 density profiles.

6970 (CONF-9109229–2) **Steady-state creep of hot-pressed silicon carbide whisker-reinforced silicon nitride.** Koester, D.A. (North Carolina State Univ., Raleigh, NC (United States). Dept. of Materials Science and Engineering); Davis, R.F.; More, K.L. Oak Ridge National Lab., TN (United States). [1991]. 8p. Sponsored by U.S. DOE Conservation & Renewable Energy; U.S. Department of Defense. DOE Contract AC05-84OR21400. Grant DAALOG-86-0013. From 1. Canadian international composites conference and exhibition; Montreal (Canada); 4-6 Sep 1991. Order Number DE92004461. Source: OSTI; NTIS; GPO Dep.

The research reported herein concerns the constant compressive stress creep behavior of a 30 vol% SiC whisker-reinforced Si_3N_4 containing 6.0 wt% Y_2O_3 and 1.5 wt% Al_2O_3 additives. Creep data will be presented and integrated with an examination of the microstructure obtained via transmission electron microscopy (TEM) and scanning electron microscopy (SEM).

6971 (DOE/ER/45209–6) **Defect structure of semiconducting and insulating epitafial oxides: Progress report, May 1, 1991–April 30, 1992.** Wessels, B.W. Northwestern Univ., Evanston, IL (United States). [1991]. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-85ER45209. Order Number DE92005080. Source: OSTI; NTIS; GPO Dep.

The study of the defect structure of semiconducting and insulating epitaxial oxides has continued. During this period, the growth and characterization of epitaxial $BaTiO_3$ and $SrTiO_3$ layers were undertaken. For the growth of the epitaxial oxides, an organometallic chemical vapor deposition technique was developed. For the deposition of $BaTiO_3$, we developed and used the second generation Ba precursor, barium (hexafluoroacetylacetonate)$_2$ (tetraglyme)(Ba(hfa)$_2$·tet) along with titanium tetraisoproxide as the titanium precursor. Recently, we have succeeded in depositing epitaxial $BaTiO_3$ by using single crystalline $LaAlO_3$ substrates. This development should significantly improve our electronic property and defect structure measurements since grain boundaries are eliminated in the layers. The structure of the epitaxial $BaTiO_3$ was examined using both x-ray diffractometer measurements and high-resolution transmission electron microscopy (HRTEM).

6972 (DOE/ER/45228–9) **Surfaces and interfaces of ceramics and metals for period July 1988–June 1991.** Arizona State Univ., Tempe, AZ (United States). [1991]. 39p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER45228. Order Number DE92004069. Source: OSTI; NTIS; GPO Dep.

During this three-year grant period our research program has been both expanded in its scope and established more firmly on knowledge of the basic materials involved. New techniques have been brought into play and these have allowed a more complete understanding of the nature and form of the surfaces of the oxide ceramics. There have been several surprising developments. One is the discovery of surface superlattice structures on surfaces of oxide crystals of oxide crystals (MgO, Al_2O_3, TiO_2). Unlike most of the surface-reconstruction superlattices reported in the surface science literature, these are not structures confined to ultra-high vacuum environments. They are formed by high temperature annealing in air or oxygen and are stable for extended periods of exposure to the atmosphere as well as in UHV, and hence may well be relevant to surfaces properties of the oxides under the conditions appropriate to many technological applications.

6973 (DOE/ER/45338–1) **Modeling and experimental studies of oxide covered metal surfaces: TiO_2/Ti a model system: Progress report.** Smyrl, W.H. Minnesota Univ., Minneapolis, MN (United States). [1991]. 57p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER45338. Order Number DE92004053. Source: OSTI; NTIS; GPO Dep.

Prior work in our laboratories at the Corrosion Research Center has shown that thin, anodic TiO_2 films formed by the Slow Growth Mode (SGM) on polycrystalline titanium and microcrystalline with a texture that varies from one metal grain to another. Furthermore, the underlying metal grains are mapped by the photoelectrochemical response of the oxide. The same characteristics have also been demonstrated in our laboratory for ZnO grown on Zn. The TiO_2/Ti system has been chosen for study both because of its importance in energy systems, and because it can serve as a model system for other metal-metal oxide couples. The investigations of anodic TiO_2 films on Ti have shown that the properties of thin films are consistent with the rutile form of the oxide. Both experimental data and theoretical calculations show the close resemblance to results on single crystal TiO_2. Furthermore, the modeling studies reveal that the optical transitions near the bandedge arise from the bulk band structure. The photoelectrochemical properties of anodic TiO_2 films have now been shown to obey the simple Gaertner-Butler model for the semiconductor-electrolyte interface, with a few modifications. The most important deviation has now been shown to be a result of multiple internal reflections in the oxide film.

6974 (ENEA-RT-INN–90-56) **Composite ceramic powders obtained by laser induced reactions of silane and amines.** Borsella, E.; Botti, S.; Fantoni, R.; Alescandrescu, R.; Morjan, I.; Dikonimos-Makris, T.; Giorgi, R.; Enzo, S. ENEA, Frascati (Italy). Dipt. Sviluppo Tecnologie di Punta; ENEA, Casaccia (Italy). Area Energia e Innovazione; Venice Univ. (Italy). Jun 1991. 30p. (RT/INN–90-56). Order Number DE92744020. Source: OSTI; NTIS (US Sales Only).

Ultrafine, ternary (Si/C/N) ceramic powders were produced after CO_2 laser initiated reactions between silane and mono- or dimethylamine. Several chemical and spectroscopic diagnostics (mass spectrometry, chemical analysis, IR spectrophotometry, X-Ray photo-electron spectroscopy, X-Ray diffraction analysis) were employed to correlate the parameters relevant to gas phase reactions and the final composition of the powder.

6975 (ENEA-RT-NUCL–90-47) **Transport properties of Bi-Sr-Ca-Cu-O and Y-Ba-Cu-O single crystals.** Boffa, V.; Murtas, F.; Paterno', G.; Gambardella, U.; Paroli, P.; Licci, F. ENEA, Frascati (Italy). Area Nucleare; Rome-2 Univ. (Italy). Jun 1991. 10p. (CONF-9009458–1: 1990 applied superconductivity conference, Snowmass Village, CO (United States), 24 Sep 1990; RT/NUCL–90-47). Order Number DE92744025. Source: OSTI; NTIS (US Sales Only).

From 1990 applied superconductivity conference; Snowmass Village, CO, USA (24-28 Sep 1990).

The ability of type two superconductors to carry large critical currents, in the presence of high magnetic fields, is related to the pinning force acting on the flux lines. In the new high temperature superconductors, the pinning barrier energy is relatively low, and flux motion effects are unusually large. The knowledge of the pinning energy is very important in order to understand the transport properties of these materials. Recently, it has been shown that the broadening of the resistive transition of single crystals in the presence of magnetic fields can be related to thermally activated flux motion (flux creep). This paper reports on an investigation of the temperature dependence of the resistance of $Bi_2Sr_2CaCu_2O_y$ and $YBa_2Cu_3O_y$ single crystals in the presence of an external field of up to 6 Tesla with the magnetic field directed along the c axis. The measurements were performed with a d.c. bias by a four leads configuration. The data are discussed with reference to the thermally activated flux motion and with the temperature dependence of the activation energy taken into account.

6976 (INIS-mf–13025 vp.) **Solid state chemistry of uranium plutonium mixed oxide (Preprint no. IT-04).** Naito, Keiji (Nagoya Univ. (Japan)). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. Feb 1991. 685p. (CONF-9102132–: International symposium on radiochemistry and radiation chemistry - plutonium 50, Bombay (India), 4-7 Feb 1991). In *International symposium on radiochemistry and radiation chemistry (Plutonium - 50 years) (held at Bombay during February 4-7, 1991): Preprints volume.* Order Number DE92001334. Source: OSTI; NTIS (US Sales Only); INIS.

The defect structures and related properties of uranium-plutonium mixed oxide, (U,Pu)Osub(2±x') at high temperatures are reviewed mainly based on the results by the present authors by means of electrical conductivity measurement and thermogravimetry, in comparison with doped UOsub(2±x). (author). 2 refs., 3 figs.

6977 (INIS-mf–13025 vp.) **Studies of properties of plutonium based fuels at Cadarache (preprint no. IT-02).** Guerin, Y. (Commissariat a' l' Energie Atomique, Cadarache (France)); Philipponneau, Y. Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. Feb 1991. 685p. (CONF-9102132–: International symposium on radiochemistry and radiation chemistry - plutonium 50, Bombay (India), 4-7 Feb 1991). In *International symposium on radiochemistry and radiation chemistry (Plutonium - 50 years) (held at Bombay during February 4-7, 1991): Preprints volume.* Order Number DE92001334. Source: OSTI; NTIS (US Sales Only); INIS.

Some of the studies performed at Cadarache on $(U,Pu)O_2$ are presented and discussed. The thermal conductivity and the oxygen potential are considered and attention on the influence of irradiation on these properties is drawn. (author). 23 refs., 4 figs.

6978 (INIS-SU–290, pp. 86) **Radiation-induced activation of high-basic silicates, aluminates and calcium alumoferrite.** Egorov, G.B.; Oganesyan, P.L.; Panin, Yu.A.; Snegirev, V.E. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. ALUMINATES/radioactivation; SILICATES/radioactivation; ALUMINATES; RADIOACTIVATION; COBALT 60; DOSE RATES; DOSE-RESPONSE RELATIONSHIPS; GAMMA RADIATION; SILICATES

6979 (INIS-SU–290, pp. 104-105) **Radiation stability of lithium-bearing ceramic materials.** Kizane, G.K. (Latvijskij Gosudarstvennyj Univ., Riga (USSR)); Tiliks, Yu.E.; Supe, A.A.; Tiliks, Yu.Yu. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. CERAMICS/radiation effects; CERAMICS; CRYSTAL DEFECTS; LITHIUM COMPOUNDS; MAGNETIC FIELDS; NIOBATES; SILICATES; SURFACE PROPERTIES; ZIRCONATES

6980 (IS-T–1601) **Silyl-acetylene polymers for use as precursors to silicon carbide fibers.** Meyer, M.K. Ames Lab., IA (United States). 20 Dec 1991. 195p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. Order Number DE92005097. Source: OSTI; NTIS; GPO Dep.

The steps involved in production of silicon carbide fiber using silyl acetylene polymer precursors can be separated into four processing steps: polymer synthesis, fiber spinning, fiber crosslinking, and pyrolysis. Practical experimental considerations in each step are discussed.

6981 (Juel–2475) **The influence of the oxygen partial pressure on the quasi-ternary system Cr-Mn-Ti-oxide.** Garcia-Rosales, C.; Schulze, H.A.; Naoumidis, A.; Nickel, H. Forschungszentrum Juelich GmbH (Germany). Inst. fuer Reaktorwerkstoffe; Technische Hochschule Aachen (Germany). May 1991. 123p. (In German). Order Number DE92758890. Source: OSTI; NTIS (US Sales Only); INIS.

Dissertation submitted by C. Garcia-Rosales.

The passivation layers formed by the oxidizing corrosion of high temperature alloys consist primarily of oxides and mixed oxides of the elements chromium, manganese and titanium. For a reproducible formation and characterization of such oxide layers it is necessary to know the phase equilibria of these oxide systems at temperature and oxygen partial pressure conditions which will be relevant during their application. For the investigation of the quasi-ternary system Cr-Mn-Ti-oxide, oxide powders were prepared and annealed at 1000deg C under different oxygen partial pressures ranging from 0.21 bar to 10^{-21} bar. Phase identification and determination of lattice parameter using X-ray diffraction analysis as well as the direct measurement of phase boundaries as a function of oxygen partial pressure using the emf-methode were carried out for these investigations. In the quasi-ternary system Cr-Mn-Ti-oxide the spinels play a decisive role in the oxigen partial pressure range examined. The spinel $MnCr_2O_4$ may be regarded as the most significant compound. Part of the chronium can be replaced by trivalent manganese at high oxygen partial pressures and by trivalent titanium at low pressures, and the formation of a solid solution with the spinel Mn_2TiO_4 is possible in all cases. In this way a coherent single-phase spinel region is observed which extends over the entire oxygen partial pressure range form 0.21 bar to 10^{-21} bar examined at 1000deg C. (orig.).

6982 (Juel-2487) **Properties of plasma sprayed oxides on metallic substrates.** Schuetz, H.G. Forschungszentrum Juelich GmbH (Germany). Inst. fuer Angewandte Werkstofforschung; Technische Hochschule Aachen (Germany). Jun 1991. 150p. (In German). Order Number DE92758988. Source: OSTI; NTIS (US Sales Only).

Metallic substrates were coated with Cr_2O_3, Al_2O_3, ZrO_2-7%Y_2O_3 by plasma spray technique. An aim of this work was the investigation of the bonding mechanism between substrate and coating. From the results achieved by several analyzing methods (SEM, SNMS) it was concluded that mechanical bonding of the spray particles on rough metallic substrate surfaces was the dominant adhesion mechanism. In a second step the influence of substrate material and -temperature on residual stress condition in chromia coatings was investigated. As analyzing method X-ray diffraction was applied. Further the phase composition of oxides was determined in dependance of the different process variants applied APS (= atmospheric plasma spraying), VPS (= vacuum plasma spraying) and IPS (= inert gas plasma spraying). Post heat treatment of coated samples influenced the phase composition and produced chemical reactions at the coating/substrate interface. (orig.).

6983 (KAERI/RR-977/90) **The development of SiC whisker fabrication technology for nuclear applications.** Kang, Thae Khapp (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Kuk, Il Hiun; Kim, Chang Kyu; Lee, Jae Chun; Lee, Ho Jin; Park, Soon Dong; Im, Gyeong Soo. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Feb 1991. 139p. (In Korean). Order Number DE92614834. Source: OSTI; NTIS (US Sales Only); INIS.

Some important experiments for whisker growth reactions, fabrication processes, and experiments for fabricarion of whisker reinforced composites have been performed. In order to investigate growth reaction of SiC whiskers, a conventional carbothermic reaction was tested. Based on the results of carbothermic process, a new process called silicothermic reaction was planned and some basic experiments were performed. Reaction characteristics of silicon monoxide, core material for SiC whisker growth in both of the reactions were investigated for basic data. Additionally, a hydrofluoric acid leaching process was tested for developing SiC whisker recovery process, and powder metallurgy process and melt sqeeze process were tried to develop aluminum-SiC whisker composites. (Author).

6984 (KCP-613-4480) **Selective plasma etching: Final report.** Franti, G.W. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. Dec 1991. 14p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00613. Order Number DE92004794. Source: OSTI; NTIS; GPO Dep.

Plasma etching of silicon nitride glassivation layers on silicon dice using CF_4 was successfully carried out with a commercial plasma etcher. The parameters of power level and partial pressure gas were downscaled from the commercial plasma etcher to a bench-top plasma etcher. Plasma etching of silicon nitride was successfully performed in the bench-top plasma etcher. 1 ref., 6 figs.

6985 (LBL-29964) **Structural and interfacial characteristics of thin (<10 nm) SiO_2 films grown by electron cyclotron resonance plasma oxidation on [100] Si substrates.** Nguyen, T.D.; Carl, D.A.; Hess, D.W.; Lieberman, M.A.; Gronsky, R. Lawrence Berkeley Lab., CA (United States). Apr 1991. 12p. Sponsored by U.S. DOE Energy Research; U.S. Department of Defense; National Science Foundation. DOE Contract AC03-76SF00098 ;FG03-87ER13727. Contract F49620-87-K-0001;Grant ECS-8517363;Grant ENG-8710988. (CONF-910406-38: Spring meeting of the Materials Research Society (MRS), Anaheim, CA (United States), 29 Apr - 3 may 1991). Order Number DE92004425. Source: OSTI; NTIS; INIS; GPO Dep.

The feasibility of fabricating ultra-thin SiO_2 films on the order of a few nanometer thickness has been demonstrated. SiO_2 thin films of approximately 7 nm thickness have been produced by ion flux-controlled Electron Cyclotron Resonance plasma oxidation at low temperature on [100] Si substrates, in reproducible fashion. Electrical measurements of these films indicate that they have characteristics comparable to those of thermally grown oxides. The thickness of the films was determined by ellipsometry, and further confirmed by cross-sectional High-Resolution Transmission Electron Microscopy. Comparison between the ECR and the thermal oxide films shows that the ECR films are uniform and continuous over at least a few microns in lateral direction, similar to the thermal oxide films grown at comparable thickness. In addition, HRTEM images reveal a thin (1–1.5 nm) crystalline interfacial layer between the ECR film and the [100] substrate. Thinner oxide films of approximately 5 nm thickness have also been attempted, but so far have resulted in nonuniform coverage. Reproducibility at this thickness is difficult to achieve.

6986 (ORNL/Sub-85-55901/02) **Finite volume model for forced flow/thermal gradient chemical vapor infiltration.** Starr, T.L.; Smith, A.W. Oak Ridge National Lab., TN (United States); Georgia Tech Research Inst., Atlanta, GA (United States). Mar 1991. 26p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC05-84OR21400. Order Number DE92003765. Source: OSTI; NTIS; GPO Dep.

The forced flow/thermal gradient chemical vapor infiltration process (FCVI) has proven to be a successfully technique for fabrication of ceramic matrix composites. It is particularly attractive for thick components which cannot be fabricated using the conventional, isothermal method (ICVI). Although it offers processing times that are at least an order of magnitude shorter than ICVI, FCVI has not been used to fabricate parts of complex geometry and is perceived by many to be unsuitable for such components. The major concern is that selection and control of the flow pattern and thermal profile for optimum infiltration can be a difficult and costly exercise. In order to reduce this effort, we are developing a computer model for FCVI that simulates the densification process for given component geometry, reactor configuration and operating parameters. Used by a process engineer, this model can dramatically reduce the experimental effort needed to obtain uniform densification.

6987 **Low density metal hydride foams.** Maienschein, J.L.; Barry, P.E. To Dept. of Energy. 1990. Filed date 31 May 1990. USA Patent patent application 7-531,363. 28p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE92003729. Source: OSTI; NTIS; GPO Dep.

Disclosed is a low density foam having a porosity of from 0 to 98% and a density less than about 0.67 gm/cc, prepared by heating a mixture of powdered lithium hydride and beryllium hydride in an inert atmosphere at a temperature ranging from about 455 to about 490 K for a period of time sufficient to cause foaming of said mixture, and cooling the foam thus produced. Also disclosed is the process of making the foam. 6 figs.

6988 **High density crystalline boron prepared by hot isostatic pressing in refractory metal containers.** Hoenig, C.L. To Dept. of Energy. 1990. Filed date 18 Jun 1990. USA Patent patent application 7-539,392. 12p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE92003749. Source: OSTI; NTIS; GPO Dep.

Boron powder is hot isostatically pressed in a refractory metal container to produce a solid boron monolith with a bulk density at least 2.22 g/cc and up to greater than 2.34 g/cc. The refractory metal container is formed of tantalum, niobium, tungsten, molybdenum or alloys thereof in the form of a canister or alternatively plasma sprayed or chemical vapor deposited onto a powder compact. Hot isostatic pressing at 1800°C and 30 KSI (206.8 MPa) argon pressure for four hour produces a bulk density of 2.34 g/cc. Complex shapes can be made.

6989 (PNL-SA-19687) **Thermal conductivities of thin, sputtered optical films.** Henager, C.H. Jr.; Pawlewicz, W.T. Pacific Northwest Lab., Richland, WA (United States). May 1991. 33p. Sponsored by U.S. DOE Nuclear Energy; U.S. Department of Defense. DOE Contract AC06-76RL01830. Contract RADC F3 0602-90-F-0008. Order Number DE92004486. Source: OSTI; NTIS; INIS; GPO Dep.

The normal component of the thin film thermal conductivity has been measured for the first time for several advanced sputtered optical materials. Included are data for single layers of boron nitride (BN), aluminum nitride (AlN), silicon aluminum nitride (Si-Al-N), silicon aluminum oxynitride (Si-Al-O-N), silicon carbide (SiC), and for dielectric-enhanced metal reflectors of the form $Al(SiO_2/Si_3N_4)^n$ and $Al(Al_2O_3/AlN)^n$. Sputtered films of more conventional materials like SiO_2, Al_2O_3, Ta_2O_5, Ti, and Si have also been measured. The data show that thin film thermal conductivities are typically 10 to 100 times lower than conductivities for the same materials in bulk form. Structural disorder in the amorphous or very fine-grained films appears to account for most of the conductivity difference. Conclusive evidence for a film/substrate interface contribution is presented.

6990 (RFP-4528) **Fabrication of aluminum nitride crucibles for molten salt and plutonium compatibility studies.** Phillips, J.A. EG and G Rocky Flats, Inc., Golden, CO (United States). Rocky Flats Plant. 24 Jul 1991. 195p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC34-90DP62349. Order Number DE92004002. Source: OSTI; NTIS; INIS; GPO Dep.

Thesis submitted to Colorado School of Mines, Golden, CO.

The overall objective of this research was to fabricate a calcium oxide sinter-aided aluminum nitride crucible and determine the compatibility of this crucible with molten chloride salts and plutonium metal in the DOR process. Calcium oxide sinter-aided aluminum nitride was preferred over yttrium oxide sinter-aided aluminum nitride because of (1) the presence of calcium chloride, calcium oxide, and calcium metal in the molten salts utilized in the DOR process, and (2) the higher volatility of the secondary phases formed compared with phases resulting from the addition of yttrium oxide during the aluminum nitride sintering process. The calcium oxide system may yield a higher purity crystal structure with fewer secondary phases present than in the yttrium oxide system. The secondary phases that are present in the grain boundaries may be unreactive with the calcium chloride salt due to the presence of calcium in the secondary phases.

3606 Other Materials

Refer also to citation(s) 6194, 6423, 6436, 6449, 6520, 6523, 6526, 6528, 6564, 6671, 6849, 6902, 6903, 6946, 6986, 7114, 7188, 7189, 7213, 7221, 7232, 7453, 7588, 8136, 8160, 8170, 8180, 8181, 8326

6991 (ANL-89/34) **Chemical alteration of limestone and marble samples exposed to acid rain and weathering in the eastern United States, 1984–1988.** Reimann, K.J. Argonne National Lab., IL (United States). Jun 1991. 105p. Sponsored by U.S. Department of the Interior. DOE Contract W-31109-ENG-38. Order Number DE92004050. Source: OSTI; NTIS; GPO Dep.

In a long-term program that began in 1984, limestone and marble briquettes have been exposed to both anthropogenic acid deposition and natural weathering of four field sites in the eastern United States. Similar tests began at an Ohio site in 1986. Effects of exposure on the briquettes and other materials at the sites are evaluated periodically by several federal agencies cooperating in the National Acid Precipitation Assessment Program (NAPAP). A primary contribution of Argonne National Laboratory to the NAPAP has been chemical analysis to determine changes in the samples caused by exposure to the environment. Wet chemical analysis was used to detect sulfates, nitrates, fluorides, chlorides, and a series of metal cations in sequential layers of stone removed from the briquettes after field exposure. Results from the first four years of the program indicate that rinsing by rain keeps skyward-facing stone relatively clean of reaction products, especially sulfate, the most abundant product. On groundward-facing samples, sulfate concentrations increased linearly with exposure time, and values were proportional to atmospheric SO_2 concentrations at the site. Sulfate concentrations in groundward samples were much higher in limestone than in marble, because of the greater porosity of the limestone. A steep sulfate gradient was seen in both sample types from the surface to the interior. On skyward surfaces, material losses per rain event due to complete dissolution of accumulated sulfates were approximately equal to concentrations measured in runoff. Preexposed limestone samples had sulfate accumulations deep in their interiors, while fresh, unexposed limestone did not. No substantial changes in cation accumulations wee detected in either limestone or marble.

6992 (BNL-46226) **Determination of polymerization particle morphology using synchrotron computed microtomography.** Jones, K.W. (Brookhaven National Lab., Upton, NY (United States)); Spanne, P.; Lindquist, W.B.; Conner, W.C.; Ferrero, M. Brookhaven National Lab., Upton, NY (United States). Oct 1991. 18p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract AC02-76CH00016 ;FG02-90ER25084. Grant CTS 89-21381. (CONF-910921-1: 2. European conference on accelerators in applied research and technology, Frankfurt am Main (Germany), 3-7 Sep 1991). Order Number DE92004992. Source: OSTI; NTIS; INIS; GPO Dep.

Polymerization of monomers over heterogeneous catalysts results in the fragmentation of the catalysts and subsequent transport in the polymer particles that are produced. Characterization of the process using nondestructive synchrotron computed microtomography techniques makes possible measurement of the distribution of the catalyst fragments in an individual particle and, in addition, gives an estimate of the particle porosity and surface area. The present experiment was carried out using the x-ray microscopy facility at the Brookhaven National Synchrotron Light Source (NSLS) X26 beam line. The tomographic sections were analyzed using autocorrelation techniques to determine porosity and surface area values. The results are compared to values obtained using conventional methods. This procedure makes possible the extraction of quantitative information about porosity and specific area from the tomograms. 9 refs., 7 figs., 1 tab.

6993 (CONF-911154-1) **Use of energetic ion beams in materials synthesis and processing.** Appleton, B.R. Oak Ridge National Lab., TN (United States). [1991]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From International conference on evolution in beam applications; Takasaki (Japan); 5-8 Nov 1991. Order Number DE92003529. Source: OSTI; NTIS; GPO Dep.

A brief review of the use energetic ion beams and related techniques for the synthesis, processing, and characterization of materials is presented. Selected opportunity areas are emphasized with examples, and references are provided for more extensive coverage.

6994 (CONF-911202-21) **Annealing of Pb-implanted $SrTiO_3$ in the presence of water vapor: A study using $D_2{}^{18}O$ labelling.** McCallum, J.C. (Royal Melbourne Inst. of Tech. (Australia). Microelectronics and Materials Technology Centre); Simpson, T.W.; Mitchell, I.V.; Rankin, J.; Boatner, L.A. Oak Ridge National Lab., TN (United States). [1991]. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Annual fall meeting of the Materials Research Society; Boston, MA (United States); 2-6 Dec 1991. Order Number DE92005168. Source: OSTI; NTIS; GPO Dep.

We report new measurements of the regrowth behaviour of Pb-implanted $SrTiO_3$ crystals in the presence of water vapour. Doubly labelled water vapour, $D_2{}^{18}O$, at greater than 95% enrichment in each isotope has been added to the annealing ambient and depth profiles of D and ^{18}O have been obtained from the regrown crystals using secondary ion mass spectrometry (SIMS). The D and ^{18}O content has also been measured by nuclear reaction analysis

(NRA) using the reactions D(^{3}He, p)^{4}He and ^{18}O(pα)^{15}N. The crystals were regrown in a conventional furnace under a controlled gas ambient and time-resolved optical reflectivity (TRR) was used to dynamically monitor the regrowth rate during the anneal. An enhancement of the solid-phase epitaxial regrowth rate is observed when water vapour is added to the annealing ambient. This rate increase is accompanied by incorporation of D throughout the regrown layer. ^{18}O is incorporated into the lattice but does not appear to penetrate deep enough to influence the regrowth rate.

6995 (CONF-911272–1) **Ultra-high temperature (>2000°C) testing capability at Oak Ridge National Laboratory for carbon materials in air, inert gas and vacuum.** Huddleston, R.L.; O'Connor, D.G. Oak Ridge National Lab., TN (United States). [1991]. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From International symposium on ultra-high temperature materials; Tajimi City (Japan); 7 Dec 1991. Order Number DE92004445. Source: OSTI; NTIS; GPO Dep.

A new ultra-high temperature multiaxial (axial-torsional) test system concept is being developed for testing of carbon-carbon composite materials at temperatures up to 2200°C in air, argon, and vacuum. The basic system concept incorporates computer control of temperature, pressure, and strain, displacement, or load versus time such that one can either test materials in the conventional monotonic or cyclic mode or "fly a temperature-pressure-stress vs time profile" to simulate a vehicle trajectory from ground level to space or vice versa. A unique spherical hydrostatic bearing concept is being developed which should permit the system to transmit both axial and torsional loadings with low induced bending moments. The basic test system has been assembled and shakedown tests of ATJ graphite specimens conducted at temperatures up to 1910°C.

6996 (CONF-9106303–, pp. 165-166) **Improved utilization of coal derived fly ash in concrete.** Liskowitz, J.W. (New Jersey Inst. of Tech., Newark (United States)); Cerkanowicz, A.E.; Wecharatana, M. USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-90PC90299. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

Successful use of coal derived fly-ash in the formulation of concrete currently depends on long term testing of the suitability of sample ash-concrete formulations prior to ash acceptance. Existing tests have proven unreliable and have not provided correlation between formulated concrete strength and fly-ash/combustor/coal characteristics. This program represents a study of the interrelationship between the ash formation process, the ash properties, and the concrete quality. Given the coal type, and the combustion and ash collection conditions, the authors expect to predict the optimum use of the captured ash in concrete formulation. They further intend to use these results to develop an innovative ash quality test. Significant quantity of commercially generated coal fly-ash employing different combustion and collection processes has been obtained for evaluation. The influence of ash particle size, particle size distribution, surface and bulk chemical composition, and leaching treatments on fly-ash/concrete strength are being evaluated as a function of curing time.

6997 (DOE/ER/12107–1) **A study of potential high band-gap photovoltaic materials for a two step photon intermediate technique in fission energy conversion: Progress report for year one, December 1, 1990–November 30, 1991.** Missouri Univ., Columbia, MO (United States). 16 Aug 1991. 33p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-91ER12107. Order Number DE92004046. Source: OSTI; NTIS; GPO Dep.

A diamond synthesis chamber and an ion implanter have been constructed. Work has been rapidly progressing and diamond has been synthesized. There are five variables which affect the quality of diamond: (1) mass flow of methane, (2) mass flow of hydrogen, (3) filament temperature, (4) substrate temperature, and (5) substrate material. Enclosec are pictures and data of previous diamond growth experiments. Current work is focused on the conditions which produce the best quality diamond films. In this study, diamond films were deposited using a hot-filament CVD method with boron trioxide (B_2O_3) and diphosphorus pentoxide (P_2O_5) as the doping sources. P_2O_5 is the only known effective phosphorus source for forming n-type semiconducting material. An RF generator has been made operation for epitaxial growth of AlN by the chemical vapor deposition method. In initial experiments with a graphite substrate, the RF generator heated the material to a temperature of 1100°C. A reactor which will use the RF generator has been built for AlN synthesis. The device should be assembled and tested by the end of August. A new process for fabricating platinum silicide photovoltaic cells has been developed. A diffused guard ring has been added to minimize leakage current. VUV to near IR capability has been developed for optical characterization. A microwave driven excimer lamp has been built and tested. Our previous work used a microwave source on an electron cyclotron heated ion source.

6998 (DOE/ER/13482–6) **Transport properties of disordered porous media from the microstructure: Progress report, March 1, 1991–February 28, 1992.** Torquato, S. North Carolina State Univ., Raleigh, NC (United States). Dept. of Mechanical and Aerospace Engineering. Nov 1991. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-86ER13482. Order Number DE92005467. Source: OSTI; NTIS; GPO Dep.

Progress has been made in five general areas: (1) the development of cross-property relations, i.e., relationships between one effective property and a different effective property; (2) the development of a systematic means to represent and calculate statistical correlation functions that arise in rigorous property relations for heterogeneous media, using statistical-mechanical methods; (3) the derivation and calculation of property relations which depend upon this microstructural information; (4) sterically hindered fragmentation in reactive solids using percolation theory and simulations; and (5) the use of Brownian-motion simulation techniques to "exactly" predict the effective properties of disordered media. We embarked on a new area of research, namely, the study of passive advection of tracer particles in random velocity fields.

6999 (DOE/ER/14185–1) **Ultrafast optical studies of surface reaction processes at semiconductor interfaces: Progress report, June 1, 1991–May 31, 1992.** Miller, R.J.D. Rochester Univ., NY (United States). Nov 1991. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-91ER14185. Order Number DE92004019. Source: OSTI; NTIS; GPO Dep.

Electron transfer processes at interfaces constitute a large and important class of surface reactions. In addition, the rectifying properties of semiconductor interfaces makes these systems one of the simplest and most efficient systems for converting and storing optical energy. However, the primary events of interfacial electron or hole carrier transfer and competing non-radiative (energy loss) channels are not well understood at surfaces. This research has explored the use of two novel optical techniques, Surface Space Charge Electro-optic Sampling and Surface Restricted Transient Grating Spectroscopy, to obtain the time evolution of the surface spatial distribution of photogenerated charge carriers and the photocarrier population dynamics at semiconductor interfaces, respectively. These studies have shown that carriers arrive at GaAs (100) surfaces on the hundred femtosecond time scale and subsequently undergo interfacial charge transfer on the picosecond time scale to appropriate acceptors. These dynamics are competitive with carrier thermalization processes and support the concept that it may be possible to significantly improve energy conversion efficiencies by minimizing energy loss through carrier thermalization. The exact dynamics still need to be resolved. A new laser system has been developed in the first year of funding that is capable of 10 femtosecond time resolution. This system will have sufficient time resolution to completely resolve both the electron and hole carrier non-radiative relaxation processes as well as the interfacial carrier charge transfer dynamics.

7000 (DOE/ER/45220–8) **Mixed-ionic and electronic conductivity in polymers: Annual technical progress report.** Ratner, M.A.; Shriver, D.F. Northwestern Univ., Evanston, IL (United States). [1991]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-85ER45220. Order Number DE92005076. Source: OSTI; NTIS; GPO Dep.

The aim in this portion of the research is to prepare new electroactive films with high ion mobility, and to characterize the transport properties of these materials. The classic conducting polymers, polyacetylene, polythiophene, and polypyrrole have dense structures that prevent rapid redox switching because of the low diffusivity of ions. The objective is to modify the last two polymers with pendant polyethers, which should greatly improve ion transport.

7001 (DOE/ER/45409–2) **Photomodulation spectroscopy of photocarrier dynamics, electronic defects and morphology of conducting polymers: Progress report.** Vardeny, Z.V. Utah Univ., Salt Lake City, UT (United States). Dept. of Physics. 8 Oct 1991. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-89ER45409. Order Number DE92004687. Source: OSTI; NTIS; GPO Dep.

This is a progress report on the second period of activities associated with the DOE grant to the Physics Department of the University of Utah, starting on April 1st, 1991, on photocarrier dynamics, electronic defects and morphology of conducting polymers using the photomodulation spectroscopy. During the second period of this grant we have achieved impressive results and have started new studies, to be completed during the grant continuation period of the third year. We will describe our progress according to the material studied, since this is the best method to summarize our accomplishments. We have used a variety of techniques in our studies such as: CW photomodulation, photomodulation in the femtosecond and picosecond time ranges, CW resonant Raman scattering, transient photoinduced Raman scattering, electroabsorption, degenerate four-wave mixing and the newly technique of spin dependent photomodulation. These techniques have been used to obtain the transient electronic response of the studied conducing polymers.

7002 (ENEA-RT-NUCL–90-46) **Superconducting properties of high density Y-Ba-Cu-O sintered samples.** Boffa, V.; Murtas, F.; Paterno', G.; Alvani, C.; Casadio, S.; Penna, M.; Di Gioacchino, D.; Gambardella, U.; Vaccarazza, C. ENEA, Frascati (Italy). Area Nucleare; ENEA, Casaccia (Italy). Area Energia e Innovazione; Istituto Nazionale di Fisica Nucleare, Frascati (Italy). Lab. Nazionale di Frascati. Jun 1991. 11p. (CONF-9009458–2: 1990 applied superconductivity conference, Snowmass Village, CO (United States), 24 Sep 1990; RT/NUCL–90-46). Order Number DE92744026. Source: OSTI; NTIS (US Sales Only).

From 1990 applied superconductivity conference; Snowmass Village, CO, USA (24-28 Sep 1990).

Resistive transitions and dc transport critical currents were measured on $YBa_2Cu_3O_{7-x}$ pellets. The samples were fabricated by the powder method at sintering temperatures ranging from 900 to 940 degrees C. They had a relative density higher than 92% of the theoretical density assumed equal to 6.36 g/cubic cm. The dependence of the critical current upon a weak applied field, up to 3 m Tesla, at liquid nitrogen temperature, was investigated. For a few samples, the temperature dependence of the resistance was measured in a magnetic field up to 5 Tesla. In this paper, the results were analyzed in terms of differences in sintering conditions.

7003 (INIS-BR–2853) **Study irradiation damage by fast neutrons in Portland cement by means of ultra-sound.** Rosa Junior, A.A. Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, SP (Brazil). 1988 89p. (In Portuguese). Order Number DE92613450. Source: OSTI; NTIS (US Sales Only); INIS.

The effect of neutron irradiation in samples of Portland cement paste was evaluated, using the resonance frequency method and pulse velocity of ultra-sound technique. The samples were divide in three groups: 1) Monitoring samples; 2) Samples to gamma heating simulation; 3) Fast neutron irradiated samples in reactor core. Santa Rita Portland cement was utilized for samples preparation with water-cement rate of 0,40 l/kg. The irradiation was performed in the research reactor IEA-R1, at IPEN-CNEN/SP, with an integrated flux of 7,2 X 10 sup(18) n/cm sup(2) (E approx. 1 Mev). The samples of group 2 were submitted to special micro-waves heat treatment-with the same number of cycles of the reactor-which allowed the detection of fast neutron radiation effects within the predominant thermal effects. (author).

7004 (INIS-BR–2886) **Growth and characterization of monocrystals from HgI_2 semiconductor compound for using in X and gamma spectroscopy.** Faria, L.O. de. Minas Gerais Univ., Belo Horizonte, MG (Brazil). Dept. de Fisica. Sep 1987 91p. (In Portuguese). Order Number DE92613447. Source: OSTI; NTIS (US Sales Only); INIS.

Mercury Iodide (HgI_2) platelets were grown from the vapor phase in the presence of polymers. These platelets are convenient to be used as room temperature operating semiconductor radiation detectors. Experiments demonstrate that the growth of platelets depends on a two-stage mass transport instead of depending on just one, as it has been thought. HgI_2 platelets 30 mm^2 large and 90 μm thick were obtained in a sealed evacuated fused quartz tube and were characterized by etch pit density measurements. (author).

7005 (INIS-SU–290, pp. 93-94) **Radiation-induced of polyethylene in the presence of inhibitors.** Zamiralov, V.S. (Moskovskij Gosudarstvennyj Univ., Moscow (USSR). Nauchno-Issledovatel'skij Inst. Yadernoj Fiziki); Piskarev, I.M.; Kharitonova, G.S. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. 2 refs. POLYETHYLENES/oxidation; POLYETHYLENES/radiation effects; DOSE RATES; FILMS; KEV RANGE 10-100; POLYETHYLENES; OXIDATION; TENSILE PROPERTIES; X RADIATION

7006 (INIS-SU–290, pp. 97) **Methods of modification of rubber coatings on polydimethylsiloxane gum.** Zdorikova, G.A.; Kolesnikov, A.A.; Komarov, S.A.; Troitskaya, T.A. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. RUBBERS/radiation curing; COATINGS; RADIATION DOSES; RUBBERS; SILOXANES; THERMAL DEGRADATION; VULCANIZATION

7007 (INIS-SU–290, pp. 101-102) **Radiation optical stability of polymer materials.** Zimina, G.M. (AN SSSR, Moscow (USSR). Inst. Ehlektrokhimii); Panteleeva, V.V.; Solina, V.F.; Zolotarevskij, V.I.; Vannikov, A.V. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. ORGANIC POLYMERS/optical properties; ORGANIC POLYMERS/radiation effects; ADHESION; DOSE RATES; DOSE-RESPONSE RELATIONSHIPS; GAMMA RADIATION

7008 (INIS-SU–290, pp. 102-103) **Influence of low- and high-molecular stabilizers on mechanical properties of radiation-modified polyethylene.** Ivanov, V.S. (Leningradskij Gosudarstvennyj Univ., Leningrad (USSR)); Migunova, I.I.; Panina, T.Eh.; Temnov, O.V. AN SSSR, Moscow (USSR); Ministerstvo

Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. POLYETHYLENES/radiation curing; POLYETHYLENES/tensile properties; DEFORMATION; DOSE RATES; GAMMA RADIATION; POLYETHYLENES

7009 (INIS-SU–290, pp. 107-108) **Radiation-cured polyethylene films and their resistance to ultraviolet radiation.** Kovalev, B.A.; Kitaev, K.N.; Kovadeva, A.G. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. POLYETHYLENES/radiation curing; ELECTRONS; HUMIDITY; MEDIUM TEMPERATURE; POLYETHYLENES; THERMAL DEGRADATION; ULTRAVIOLET RADIATION

7010 (INIS-SU–290, pp. 108-109) **Radiation-induced heating-up of polymers. Maximum temperature evaluation.** Knizhnik, E.I. (AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Yadernykh Issledovanij); Briskman, B.A.; Tokarevskij, V.V. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. POLYMERS/radiation heating; CONFIGURATION; DOSE-RESPONSE RELATIONSHIPS; LOW TEMPERATURE; NUMERICAL SOLUTION; POLYMERS; RADIATION EFFECTS; SPECIFIC HEAT

7011 (JAERI-M–91-134) **Radiation effects on polyethylene foam.** Tang Beilin (Japan Atomic Energy Research Inst., Neyagawa, Osaka (Japan). Osaka Lab. for Radiation Chemistry); Kaji, Kanako; Hatada, Motoyoshi; Yoshizawa, Iwao; Kohara, Choji. Japan Atomic Energy Research Inst., Tokyo (Japan). Sep 1991. 53p. (In Japanese). Order Number DE92751046. Source: OSTI; NTIS (US Sales Only); INIS.

Studies have been carried out on radiation effects on open cell type polyethylene foam. The foam was irradiated with electron beam either in nitrogen atmosphere or in air and changes of strength, elongation, and gel fraction were measured. The gel-percent of the original foam (50%) increased by 30% after irradiation in nitrogen, while strength measured at room temperature, 70, and 100degC did not change by the irradiation. However, elongation measured at 70 and 100degC decreased considerably and dimension stability above 70degC was also improved. (author).

7012 (KFK–4894) **Radiation resistant, decontaminable and sealing jointing compounds for application in nuclear facilities.** Kunze, S. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Nukleare Entsorgungstechnik. Sep 1991. 17p. Order Number DE92750200. Source: OSTI; NTIS (US Sales Only); INIS.

The sealing jointing compounds applied in practice and already examined for decontaminability will be presented here. Solvent-free sealing compounds, emulsifiable in water, with low molecular epoxy resins as binders, quite a number of curing versions, and little hygroscopic filler mixtures adapted in grain size have been tested with a view to ceramic tile jointing in nuclear facilities. The sealing compounds were examined before and after exposure to gamma irradiation (300 KGy energy dose) for decontaminability, color, gloss and resistance to decontaminants. Out of fourteeen compounds exhaustively investigated ten are very well decontaminable and four well decontaminable. After exposure to radiation no or only minor changes in color and gloss, respectively, were observed. Visible changes such as cracking, bubbles, etc. were not found and the resistance to decontaminants was neither affected. It has even been possible to replace in the well decontaminable sealing compounds developed until now part of the epoxy resin binder with elasticizing components such as Thiokol which is very important as a base material for sealing compounds in the construction industry, but difficult to decontaminate. (orig.).

7013 (LA-UR–91-3982) **Physical properties of superconducting and ferromagnetic materials based on C_{60}.** Thompson, J.D. (Los Alamos National Lab., NM (United States)); Sparn, G.; Diederich, F.; Gruener, G.; Holczer, K.; Kaner, R.B.; Whetten, R.L.; Allemand, P.M.; Chen, Q.; Wudl, F. Los Alamos National Lab., NM (United States). 1 Dec 1991. 8p. Sponsored by U.S. DOE Energy Research; National Science Foundation; Packard Foundation Fellowship. DOE Contract W-7405-ENG-36. (CONF-911202–12: Annual fall meeting of the Materials Research Society, Boston, MA (United States), 2-6 Dec 1991). Order Number DE92005066. Source: OSTI; NTIS; INIS; GPO Dep.

We present results of magnetization and pressure measurements on recently discovered superconductors K_3C_{60} and Rb_3C_{60}, as well as ferromagnetic C_{60} TDAE, and discuss the nature of the ground state suggested by these studies.

7014 (LBL–31390) **Far infrared conductivity of charge density wave materials and the oxygen isotope effect in high-T_c superconductors.** Creager, W.N. Lawrence Berkeley Lab., CA (United States). Sep 1991. 265p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract AC03-76SF00098. Grant DMR 84-00041;Grant DMR 83-51678. Order Number DE92004105. Source: OSTI; NTIS; INIS; GPO Dep.

The far infrared reflectance and conductivity of $(Ta_{1-x}Nb_xSe_4)_2I$ and TaS_3 have been measured to determine the origin of a huge infrared resonance that dominates the charge density wave (CDW) dynamics along with the pinned acoustic phason mode in the related materials $(TaSe_4)_2I$ and $K_{0.3}MoO_3$. The measurements cover frequencies from 3 to 700cm^{-1} and the temperature range from 15K to 300K. In the niobium-doped alloys $(Ta_{1-x}Nb_xSe_4)_2I$, the size and frequency of the giant infrared mode remain nearly constant as the impurity concentration x is increased. For TaS_3, the pinned acoustic phason near 0.5cm^{-1} dominates $\epsilon(\omega)$ and an additional small mode lies near 9cm^{-1}. The latter mode is much smaller than the infrared mode in other CDW materials. These results rule out several models of a "generic infrared mode" in CDW excitations. They are compared in detail to the predictions of a recent theory attributing the infrared mode to a bound collective mode localized at impurity sites within the crystal. The transmittance of $K_{0.3}MoO_3$ has been measured at 1.2K with a strong dc electric field applied across the crystal. Under these conditions, the charge density wave depins abruptly and carries large currents with near-zero differential resistance. For some samples, the low-frequency transmittance is enhanced slightly when the CDW depins. The magnitude of the oxygen isotope effect in the high-$T_c$superconductor $YBa_2Cu_3O_7$ has been determined by substitution of ^{18}O for ^{16}O. A series of cross-exchanges was performed on high-quality polycrystalline specimens to eliminate uncertainties due to sample heat treatments and sample inhomogeneities.

7015 (MLM–3709) **Quantitative powder x-ray diffraction analysis of the Li_2O-SiO_2 glass-ceramic system.** Tomlin, D.W. (Naval Research Lab., Washington, DC (United States)); Sullenger, D.B.; Cantrel, J.S. EG and G Mound Applied Technologies, Miamisburg, OH (United States). 28 Oct 1991. 37p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-88DP43495. Order Number DE92004777. Source: OSTI; NTIS; GPO Dep.

An improved quantitative analysis that use powder x-ray diffraction has been developed to determine the relative amounts of crystalline phases in samples of Li_2O-SiO_2 glass-ceramics. Existing methods were improved and extended, resulting in a means for estimating a sample's amorphous-to-crystalline content ratio. The quantitative polycrystalline and semi-quantitative amorphous results of this study are currently usable by the Materials Analysis Section at EG&G Mound Applied Technologies. A quality control procedure will be adapted and formulated from the methods developed in this study. 1 ref., 15 figs., 7 tabs.

7016 (MLM–3720(OP)) **Low temperature properties of engineering thermoplastics.** Kaye, C.J. EG and G Mound Applied Technologies, Miamisburg, OH (United States). [1991]. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-88DP43495. (CONF-911023–1: 23. international technical conference of the Society for the Advancement of Materials and Process Engineering, New York, NY (United States), 22-24 Oct 1991). Order Number DE92004009. Source: OSTI; NTIS; GPO Dep.

There are currently a wide variety of engineering thermoplastics available for a multitude of applications. Because of present market requirements, there has been a limited demand for test results of the physical properties of these materials at low temperatures. Several potential applications exist, however, and as a result, several engineering thermoplastic samples were tested at –40 and –56.6°C. Although not all these tests followed the procedures specified by the American Society of Testing and Materials precisely, the data represent comparative data that can be utilized for further design efforts. The evaluations included tensile testing, compressive properties, and Izod impact testing. Several materials with varied glass loadings were studied to determine the low temperature tendencies these molding compounds would exhibit. Some of the resins examined were: polyetheretherketone (PEEK), polytherimide (PEI), polyphenylene sulfide (PPS), polyethersulfone (PES), polyphthlamide (PPA), and a liquid crystal polymer (Vectra A130). In all cases, no detrimental effect was discerned over this temperature range; the study also indicated that improvements in the physical properties could be expected.

7017 (ORNL/ATD–54/R1) **Fiberglass material specification II: Revision 1.** Frame, B.J.; Janke, C.J. Oak Ridge National Lab., TN (United States). Oct 1991. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE92005405. Source: OSTI; NTIS; GPO Dep.

This report describes the requirements for composite parts to be furnished to Martin Marietta Energy Systems, Inc. Topics discussed include: Part Fabrication Requirements, Scope, and Applicable Documents.

7018 (ORNL/ATD–62) **Development of performance models for thick composites in compression.** Blake, H.W.; Grimsby, H.J.; Starbuck, J.M.; Welch, D.E. Oak Ridge National Lab., TN (United States). Applied Technology Div. Nov 1991. 114p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE92004093. Source: OSTI; NTIS; GPO Dep.

This report details initial activities and results from an investigation into the failure of thick-section composite cylinders loaded in compression. The efforts are aimed at the development of models for predicting cylinder performance based on composite material strengths derived from ring and cylinder tests of unidirectional materials. Initial results indicate that existing failure theories are applicable provided that material strength allowables are based on representative tests, and that appropriate solutions for cylinder stresses are used. Both the failure criteria and stress solution must allow for the three-dimensional stress state and for the discrete layer construction. Predictions for an initial test cylinder, which achieved a record pressure in hydrotest, are consistent with the observed performance. Performance model results obtained for a range of laminate constructions indicate this design to be optimum. Improvements in test fixturing also contributed to the record performance for this first cylinder. This work is sponsored by the Director as a three-year project funded from the Oak Ridge National Laboratory seed-money program.

7019 (ORNL/ATD–63) **Fiberglass material specification III.** Frame, B.J.; Janke, C.J. Oak Ridge National Lab., TN (United States). Applied Technology Div. Oct 1991. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE92005313. Source: OSTI; NTIS; GPO Dep.

This specification describes the requirements for composite parts of fiberglass to be furnished to Martin Marietta Energy Systems, Incorporated. (JL)

7020 (ORNL/Sub–90-SF204/1) **Corrosiveness of wet residential building thermal insulation—Mechanisms and evaluation of electrochemical methods for assessing corrosion behavior.** Stansbury, E.E. (Stansbury (E.E.), Knoxville, TN (United States)). Oak Ridge National Lab., TN (United States); Stansbury (E.E.), Knoxville, TN (United States). Oct 1991. 116p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE92004905. Source: OSTI; NTIS; GPO Dep.

An evaluation has been made of the corrosiveness of selected wet residential building thermal insulation materials in contact with low carbon steel. Investigations were conducted both in wet insulations and in filtered leachates from insulations derived from thirteen cellulosic, three mineral fiber and four foam products. Potentiodynamic polarization measurements are reported from which the overall corrosion response was assessed and then the techniques of Tafel and polarization resistance analysis applied to estimate corrosion rates. Corrosion rates were also estimated electrochemically using a direct reading instrument which performs the rate calculation based on the polarization resistance principle. Direct determinations of corrosion rate were based on weight loss measurements.

7021 **Liquid crystal polyester thermosets.** Benicewicz, B.C.; Hoyt, A.E. To Dept. of Energy. 1990. Filed date 4 Apr 1990. USA Patent patent application 7-504,217. 25p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE92003838. Source: OSTI; NTIS; GPO Dep.

The present invention relates to the field of curable liquid crystal polyester monomers and to thermoset liquid crystalline polyester compositions prepared therefrom. It is an object of this invention to provide curable liquid crystalline polyester materials. Another object of this invention is to provide a process of preparing curable liquid crystal polyester monomers. Yet another object of this invention is to provide liquid crystalline blends of polyester materials. It is a further object of this invention to provide thermoset liquid crystalline polyester compositions. It is a still further object of this invention to provide thermoset liquid crystalline polyester compositions having a high heat resistance. 1 fig.

7022 **Ammonia-treated phosphate glasses useful for sealing to metals.** Brow, R.K.; Day, D.E. To Dept. of Energy. 1990. Filed date 30 Apr 1990. USA Patent patent application 7-516,935. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE92004611. Source: OSTI; NTIS; GPO Dep.

A method of improving surface-dependent properties of phosphate glass such as durability and wear resistance without significantly affecting its thermal expansion coefficient is provided which comprises annealing the glass in a dry ammonia atmosphere at temperatures approximating the transition temperature of the glass. The ammonia annealing treatment of the present invention is carried out for a time sufficient to allow incorporation of a thin layer of nitrogen into the surface of the phosphate glass, and the treatment improves the durability of the glass without the reduction in the thermal expansion coefficient that has restricted the effectiveness of prior ammonia treatments. The improved phosphate glass resulting from this method is superior in wear resistance, yet maintains suitable thermal expansion properties so that it may be used effectively in a variety of applications requiring hermetic glass-metal seals.

7023 **Low density microcellular foams.** LeMay, J.D. To Dept. of Energy. 1990. Filed date 8 Jun 1990. USA Patent patent application 7-535,007. 45p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE92003744. Source: OSTI; NTIS; GPO Dep.

Disclosed is a process of producing microcellular from which comprises the steps of: selecting a multifunctional epoxy oligomer resin; mixing said epoxy resin with a non-reactive diluent to form a resin-diluent mixture; forming a diluent containing cross-linked epoxy gel from said resin-diluent mixture; replacing said diluent with a solvent therefore; replacing said solvent with liquid carbon dioxide; and vaporizing off said liquid carbon dioxide under supercritical conditions, whereby a foam having a density in the range of 35–150 mg/cc and cell diameters less than about 1 μm is produced. Also disclosed are the foams produced by the process.

7024 **Phosphazene polymer containing composites and method for making phosphazene polymer containing composites.** Allen, C.A.; Grey, A.E.; McCaffrey, R.R.; Simpson, B.M.; Stone, M.L. To Dept. of Energy. 1990. Filed date 30 Jul 1990. USA Patent patent application 7-559,234. 22p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC07-76ID01570. Order Number DE92003826. Source: OSTI; NTIS; GPO Dep.

It is object of the invention to provide a composite material comprised of phosphazene polymer. A feature of phosphazene-containing composites is their superior stiffness, thermal stability, and hardness which is lacking in more typical composite constituents. An advantage of using phosphazene composites is a wider range of applications, including uses in harsh environments. Another object of the present invention provides a method for producing phosphazene-containing composite materials through a pultrusion process. In brief, these and other objects are achieved by a composite produced by first coating a reinforcing material with an inorganic phosphazene compound and then polymerizing the phosphazene compound so as to confer superior thermal, physical and chemical resistance qualities to the composite. 2 figs., 6 tabs.

7025 (SAND–91-1392C) **Ge surface displacements due to low energy particles.** Picraux, S.T.; Horn, K.M.; Chason, E.; Tsao, J.Y.; Bedrossian, P.; Klitsner, T.; Brice, D.K. Sandia National Labs., Albuquerque, NM (United States). [1991]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC04-76DP00789. (CONF-911202–9: Annual fall meeting of the Materials Research Society, Boston, MA (United States), 2-6 Dec 1991). Order Number DE92004351. Source: OSTI; NTIS; GPO Dep.

The production of surface defects by low energy ^{4}He and Xe ions incident on very smooth Ge(001) 2 × 1 surfaces is reported. Roughening at -50°C by 100–500 eV is measured by RHEED in real-time using the intensity of the out-of-phase specular beam. For He the surface displacements per ion range from 0.05 to 0.3 and are comparable to our binary collision predictions of the surface vacancy production rate for a displacement threshold energy of 11 eV (3/4's of bulk value). For Se the rate ranges from 2 to 10 (~) and falls between the calculated total vacancy and total defect (vacancy + interstitial) production rates.

7026 (SAND–91-1477C) **Bonding of hydrogen implanted at 80K into III-IV semiconductors.** Stein, H.J. Sandia National Labs., Albuquerque, NM (United States). [1991]. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-911202–6: Annual fall meeting of the Materials Research Society, Boston, MA (United States), 2-6 Dec 1991). Order Number DE92004354. Source: OSTI; NTIS; GPO Dep.

Hydrogen implantation at 80K is shown to introduce As-H centers in GaAs and InAs, and P-H centers in InP. These As(P)-H centers anneal between 150 and 300K. By analogy to suggested defect assignments in electron-irradiated GaAs, it is suggested that the sites for the As(P)-H centers are metastable defects such as close vacancy-interstitial pairs. In contrast to GaAs, where absorption by Ga-H centers increases upon loss of As-H, no absorption attributable to In-H was observed in either InAs or InP. Hydrogen in an As vacancy is the suggested model for Ga-H centers. If such vacancies are thermally unstable in In-based compounds, it would explain an absence of In-H bonds and may reduce the capability for ion implantation to produce electrical isolation in In-based compound semiconductors. 19 refs., 6 figs.

7027 (SAND–91-1635C) **Collisional energy deposition threshold for extended damage depths in ion-implanted silicates.** Arnold, G.W. (Sandia National Labs., Albuquerque, NM (United States)); Battaglin, G.; Boscolo-Boscoletto, A.; Caccavalle, F.; De Marchi, G.; Mazzoldi, P.; Miotello, A. Sandia National Labs., Albuquerque, NM (United States). [1991]. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-911202–4: Annual fall meeting of the Materials Research Society, Boston, MA (United States), 2-6 Dec 1991). Order Number DE92004737. Source: OSTI; NTIS; GPO Dep.

Many properties of implanted fused silica (e.g., surface stress, hardness) exhibit maximum implantation-induced changes for collisional energy deposition values of $\sim 10^{20}$ keV/cm^3. We have observed a second critical energy deposition threshold value of about 10^{22} keV/cm^3 in stress and hardness measurements as well as in many other experiments on silicate glasses (leaching, alkali depletion, etching rate, gaseous implant redistribution). The latter show evidence for damage depths exceeding TRIM ranges by about a factor of 2. For crystalline quartz, a similar threshold value has been found for extended damage depths (greater than TRIM) for 250 kev ions (H-Au) as measured by RBS and interference fringes. This phenomenon at high damage deposition energy may involve the large stress gradients between damaged and undamaged regions and the much increased diffusion coefficient for defect transport. 13 refs., 6 figs.

7028 (SAND–91-1803C) **The use of electrophoretically deposited diamond powder coatings as a precursor for chemically vapor deposited diamond.** Panitz, J.K.G. Sandia National Labs., Albuquerque, NM (United States). [1991]. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9109319–1: 8. target fabrication specialists' meeting, Albuquerque, NM (United States), 23-26 Sep 1991). Order Number DE92003957. Source: OSTI; NTIS; GPO Dep.

It has generally been observed that in order in expedite the formation of chemical vapor deposited (CVD) diamond coatings, it is desirable to prepare a substrate by "seeding" it with diamond powder. We have determined that thick, stress free, shaped, diamond powder coatings can be electrophoretically deposited in a relatively short amounts of time. These diamond powder precursor coatings are then densified in a hot filament assisted CVD reactor to produce good quality CVD diamond/diamond powder composites. This combination of deposition techniques avoids many potential problems associated with predominantly CVD diamond.

7029 (SAND–91-2509C) **Structure and topology of silica aerogels.** Schaefer, D.W. (Sandia National Labs., Albuquerque, NM (United States)); Olivier, B.J.; Ashley, C.S.; Richter, D.; Farago, B.; Frick, B.; Hrubesh, L.; van Bommel, M.J.; Long, G. Sandia National Labs., Albuquerque, NM (United States). [1991]. 20p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789 ;W-7405-ENG-48. (CONF-910960–3: 3. international symposium on aerogels, Wuerzburg (Germany), 30 Sep - 2 oct 1991). Order Number DE92004728. Source: OSTI; NTIS; GPO Dep.

Neutron spin-echo spectroscopy is used to study the topology of aerogels. Topology or connectivity is varied through precursor chemistry and thermal annealing. Topology is characterized using the concept of fractons (the vibrational excitations of a fractal network). A qualitative difference is observed in the spectrum of polymeric vs colloidal aerogels, the latter showing a peak in the density of vibrational states. For colloidal aerogels whose structure appears to arise from phase separation in the solution precursor, low-energy excitations were only observed in the lowest density material studied. Finally, a transition from fractal to colloidal microstructure was observed during the sintering of polymeric aerogels. This transformation revealed itself as a transition from a fracton-like to a peaked density of states function. 23 refs., 7 figs.

7030 (SAND–91-2826C) **Syntheses and properties of κ-phase organic superconductors.** Wang, H.H. (Argonne National Lab., IL (United States)); Carlson, K.D.; Geiser, U.; Kini, A.M.; Schultz, A.J.; Williams, J.M.; Welp, U.; Darula, K.E.; Hitsman, V.M.; Lathrop, M.W.; Megna, L.A.; Mobley, P.R.; Yaconi, G.A.; Schirber, J.E.; Overmyer, D.L. Sandia National Labs., Albuquerque, NM (United States). [1991]. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC04-76DP00789 ;W-31109-ENG-38. (CONF-911202–8: Annual fall meeting of the Materials Research Society, Boston, MA (United States), 2-6 Dec 1991). Order Number DE92004353. Source: OSTI; NTIS; INIS; GPO Dep.

The syntheses and physical properties of κ-(ET)$_2$Cu[N(CN)$_2$]X (X=Br and Cl) are summarized. The κ-(ET)$_2$Cu[N(CN)$_2$]Br salt is the highest $T_c$radical-cation based ambient pressure organic superconductor (T_c=11.6 K), and the κ-(ET)$_2$Cu[N(CN)$_2$]Cl salt becomes a superconductor at even higher $T_c$under 0.3 kbar hydrostatic pressure (T_c=12.8 K). The similarities and differences between κ-(ET)$_2$Cu[N(CN)$_2$]Br and κ-(ET)$_2$Cu(NCS)$_2$ (T_c=10.4 K) are presented. The X-ray structures at 127 K reveal that the the S···S contacts shorten between ET dimers in the former compound while the S···S contacts shorten within dimers in the latter. The difference in their ESR linewidth behavior is also explained in terms of the structural differences. A semiconducting compound, (ET)Cu[N(CN)$_2$]$_2$, isolated during κ-(ET)$_2$Cu[N(CN)$_2$]Cl synthesis is also reported. The ESR measurements of the κ-(ET)$_2$Cu[N(CN)$_2$]Cl salt indicate that the phase transition near 40 K is similar to the spin density wave transition in (TMTSF)$_2$SbF$_6$. A new class of organic superconductors, κ-(ET)$_2$Cu$_2$(CN)$_3$ and κ-(ET)$_2$Cu$_2$(CN)$_{3-\delta}$Br$_\delta$, is reported with T_c's of 2.8 K (1.5 kbar) and 2.6 K (1 kbar), respectively.

7031 (UCRL–53868-90, pp. 4.9-4.13) **Ductile grinding of glass.** Blaedel, K.L.; Davis, P.J.; Nikkel, D.J. Jr. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

The authors goal is to develop a process that will generate finished precision optical components in less time and at a significantly lower cost. Achieving this goal would benefit the Laboratory's Laser Fusion Program as well as programs involving astronomical telescopes and space defense. Their investigation has focused on ductile or shear mode grinding. Because little is known about the behavior of glass, they have developed a multifaceted approach. They have numerically studied the stresses and deformations at the glass surface and immediately beneath the surface when a single abrasive particle indents it. In addition, they have performed scribing experiments, dragging one abrasive grit along the surface, subjecting the surface to water, and studying the cracking that results. To characterize the rate of grinding, they have developed a standardized test that utilizes the Preston Coefficient of Removal. They have observed that high-speed, fixed-abrasive ductile grinding is an order of magnitude less efficient than slow-speed lapping and polishing. Therefore, their efforts in FY 91 will focus on discovering why this occurs.

7032 (UCRL–53868-90, pp. 5.17-5.21) **Creep in fiber-reinforced epoxy-resin composites.** Feng, W.W. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

The authors are investigating time-dependent deformation, or creep, in composite materials made of carbon fibers and epoxy resin. Predicting the rate of creep is important when composite structural components must retain precise tolerances. This year they have extended their analysis of creep to include additional models as well as aging effects in adverse environments. Their work provides fundamental tools for the advancement of dimensionally precise composite design in LLNL programs.

7033 (UCRL–53868-90, pp. 5.6-5.16) **Characterizing the failure of composite structures.** Groves, S.E.; Feng, W.W.; Sanchez, R.J. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

The authors goal has been to characterize, with new experimental and theoretical methods, the three-dimensional failure response of continuous fiber composite materials. They succeeded with the primary objectives: develop both a multiaxial testing capability for continuous fiber composites using the axial/torsion/internal pressurization of tubes, and a new finite-strain-invariant failure criterion. They also completed the initial development of a specialized three-dimensional orthotropic finite element algorithm that will permit the required detailed stress/strain analysis for failure criterion evaluation. Concurrently they have also been investigating the dynamic behavior of composite materials.

7034 (UCRL-CR–105858-91-Summ.) **Development of low density silica aerogel as a capture medium for hyper-velocity particles: Summary report for FY 1991.** Hrubesh, L.W.; Poco, J.F. Lawrence Livermore National Lab., CA (United States). Oct 1991. 8p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE92003971. Source: OSTI; NTIS; GPO Dep.

We have developed a method of bonding silica aerogel to various substrate materials including aluminum, silicon, glass, and other aerogels, using a silicon compound. The bonds are stronger than the aerogel, they are transparent, and they have very low off-gassing. We have also improved the transparency of silica aerogels by modifying the sol-gel chemistry that results in the gel. The new aerogels have about 15% higher transmission through the visible and 85% higher transmission between 250 and 330nm wavelengths, as compared with conventional silica aerogels. The ultraviolet cut-off wavelength of the aerogel can be varied as desired with our developed method.

7035 (UCRL-LR–106946) **Low-density carbonized resorcinol-formaldehyde foams: Final report.** Kong, F.M.; Buckley, S.R.; Giles, C.L. Jr.; Haendler, B.L.; Hair, L.M.; Letts, S.A.; Overturf, G.E. III; Price, C.W.; Cook, R.C. Lawrence Livermore National Lab., CA (United States). 4 Jul 1991. 58p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE92004848. Source: OSTI; NTIS; INIS; GPO Dep.

This report documents research and development on resorcinol-formaldehyde-based foam materials conducted between 1986 and June 1990, when the effort was discontinued. The foams discussed are resorcinol-formaldehyde (RF) foam, carbonized RF (CRF) foam, and two composite foams, a polystyrene/RF (PS/RF) foam and its carbonized derivative (CPR). The RF foams are synthesized by the polycondensation of resorcinol with formaldehyde in a slightly basic solution. Their structure and density depend strongly on the concentration of the sodium carbonate catalyst. The have an interconnected bead structure similar to that of silica aerogels; bead sizes range from 30 to 130 Å, and cell sizes are less than 0.1 μm. We have achieved densities of 16 to 200 mg/cm^3. The RF foams can be pyrolyzed in an inert atmosphere to form a vitreous carbon foam (CRF), which has a similar microstructure but much higher mechanical strength. The PS/RF foams are obtained by filling the 2- to 3-μm cells of PS foam (a low-density hydrocarbon foam we have developed) with RF. The resultant foams have the outstanding handling and machinability of the PS foam matrix and the small cell size of RF. Pyrolyzing PS/RF foams causes depolymerization and loss of the PS; the resulting CPR foams have a structure similar to the PS foams in which CRF both replicates and fills the PS cells.

7036 Synthesis of kenyaite-type layered silicate material and pillaring of said material. Valyocsik, E.W. To Mobil Oil Corp. (USA). 7 Aug 1991. Filed date 6 Feb 1990. Canada Patent patent application 2035444. 16p. Source: Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $4.00 CAN; MF $2.75 CAN.

An improved, economical, and reproducible method is provided for preparing synthetic kenyaite-type layered crystalline silicate exhibiting high crystallinity and purity, catalytic activity, and other valuable properties. The starting mixture comprises sources of alkali metal cations (AM), silica, a non-alkali metal (M) of valence n, water, and an organic compound (R) selected from an alkylamine, a trialkylamine, a tetraalkylammonium compound, and trimethylhexamethylene diamine, the alkyl having 1-12 carbon atoms. The metal M may include any one or more of metals from Periodic Table Groups IVB, IIIA, VIB, IVA, and VIII. The mixture has a composition, in terms of mole ratios, within the following ranges: SiO_2/M_mO_n, at least ca 40; H_2O/SiO_2 5-200, $OH-/SiO_2$ 0-5, AM/SiO_2 0.05-3, R/SiO_2 0.01-3. The mixture is maintained under sufficient conditions to form crystals of the required silicate and the silicate crystals are then recovered. Experiments are described to illustrate the method of the invention. The silicate product of the invention is valuable as a catalyst component for various chemical conversion processes such as cracking, isomerization, hydrogenation, hydrogenolysis, conversion of oxygenates to other oxygenates or hydrocarbons, oxidation of alkanes, alkenes, and aromatics, and reactions of unsaturated hydrocarbons with carbon oxides. 1 fig., 4 tabs.

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Refer also to citation(s) 6170, 6175, 6188, 6205, 6211, 6222, 6228, 6249, 6323, 6331, 6354, 6367, 6479, 6485, 6488, 7068, 7098, 7166, 7168, 7510, 7571, 7610, 8137, 8138, 8171, 8376, 8387

7037 (ANL–91/26) **Nuclear technology programs semiannual progress report, April–September 1989.** Harmon, J.E. (ed.). Argonne National Lab., IL (United States). Aug 1991. 261p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. Order Number DE92003358. Source: OSTI; NTIS; INIS; GPO Dep.

This document reports on the work done by the Nuclear Technology Program of the Chemical Technology Division, Argonne National Laboratory, in the period April–September 1989. These programs involve R&D in three areas: applied physical chemistry, separation science and technology, and nuclear waste management. The work in applied physical chemistry includes investigations into the processes that control the release and transport of fission products under accident-like conditions, the thermophysical properties of metal fuel and blanket materials of the Integral Fast Reactor, and the properties of selected materials in environments simulating those of fusion energy systems. In the area of separation science and technology, the bulk of the effort is concerned with developing and implementing processes for the removal and concentration of actinides from waste streams contaminated by transuranic elements. Another effort is concerned with developing a process for separating the organic and inorganic constitutents of the red-water waste stream generated in production of 2,4,6-trinitrotoluene. In the area of waste management, investigations are underway on the performance of materials in projected nuclear repository conditions to provide input to the licensing of the nation's high-level waste repositories. 154 refs., 154 figs., 100 tabs.

7038 (CNIC–00436) **Partition chromatographic separation-spectrometry for determination of 22 trace elements in $Pu(SO_4)_2 \cdot 4H_2O$.** Meng lanxiang (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy); Zhang Qing; Feng Ainan; Gao Binghua; Ji Junying; Pan Chenlian. China Nuclear Information Centre, Beijing, BJ (China). Aug 1990. 10p. (In Chinese). (IAE–0081.). Order Number DE92613305. Source: OSTI; NTIS (US Sales Only); INIS.

The partition chromatographic separation-spectrometry for the determination of 22 trace elements in $Pu(SO_4)_2 \cdot 4H_2O$ is introduced. The 50 mg $Pu(SO_4)_2 \cdot 4H_2O$ was completely dissolved in the water-bath. In the column partition chromatography, the mixed extraction agent of TBP and TIOA(1:1) was used as stationary phase, PTFCE powder as support and 5 mol/L nitric acid as mobile phase. The trace elements to be determined were separated from 50 mg $Pu(SO_4)_2 \cdot 4H_2O$ and collected in the eluate. The lower content of Pu did not interfere in results, the indium was used as extra base and the indium and yttrium were used as internal standard elements. The 22 trace elements (AL, Be, B, Cd, Cr, Fe, Mn, Mg, Ni, P, Pb, Si, Ca, Cu, Co, Sc, Ti, V, Zn, Li, Na, K) were determined by two types of spectrographs using solution residue technique of electric arc. The range of determination of the trace elements is varied from 3×10^{-6}% to 2×10^{-2}%. The recovery of this method is varied from 83% to 120%, the precision of this method is within ±26%. 50mg $Pu(SO_4)_2 \cdot 4H_2O$ absorbed in the column can be desorbed by 5 mL 4 mol/L methanoic acid or 8mL mixed solution of 0.2 mol/L sulfuric acid and 0.1 mol/L nitric acid.

7039 (CNIC–00442) **Study of extraction-spectrophotometric micro-determination of boron with methylene blue and its application.** Zhu Daohong (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy). China Nuclear Information Centre, Beijing, BJ (China). Aug 1990. 18p. (In Chinese). (IAE–0083.). Order Number DE92613306. Source: OSTI; NTIS (US Sales Only); INIS.

A sensitive extraction-spectrophotometric method for microdetermination of boron with methylene blue was investigated. The method was based on the extraction of a BF_4^--methylene blue complex into dichloroethane. Boron was determined directly by measuring the absorbance at 658 nm. The calibration graph was linear over the range of 2.5×10^{-9} to 8×10^{-8} g/mL. The blank, mechanism of the reactions, interference of other ions and some optimum conditions of the method were studied in detail. The main source of the blank resulted from methylene blue and the complex of F^--methylene blue. In order to reduce the blank, the amounts of methylene blue, H_2SO_4 and HF were used as less as possible. Only one to one complex BF_4^--methylene blue was formed in the medium of H_2SO_4. About 90% of methylene blue and F^--methylene blue complex was removed with 5 ml of water and only a little amount of BF_4-methylene blue complex was decomposed. The extraction-spectrophotometric method with methylene blue was first applied to the microdetermination of boron in sodium metal and UF_6. The sample of sodium metal was taken and weighed in the glovebox filled with argon. Then sodium metal was oxidized, hydrolyzed, netralized and fluorizated with H_2O, H_2SO_4 and HF, respectively. The 0.5 ppm of boron in sodium metal was determined with a relative error about ±4%. This method can be applied to the determination of boron in sodium metal, sodium sulfate and sodium hydroxide at different grades. The species of boron in the hydrolysate of UF_6 is BF_4^- anion, so the sample can be directly analyzed. Boron contents in the range of 0.1 to 0.5 ppm was determined with a relative error about ±3%. Six samples could be analysed in 2h.

7040 (CNIC–00452) **Determination of calcium in sodium by vacuum distillation-atomic absorption spectrophotometry.** Wen Ximeng (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy); Su Shujuan; Sun Shiping; Liu Jingfang; Ding Dejun. China Nuclear Information Centre, Beijing, BJ (China). Nov 1990. 12p. (In Chinese). (IAE–0085.). Order Number DE92613307. Source: OSTI; NTIS (US Sales Only); INIS.

A method for determing calcium in sodium at 2 ppm or more is described. The matrix sodium was removed by vacuum distillation at 360 deg C and 5×10^{-3} Pa. The calcium in the residue was determined by atomic absorption spectrophotometry. The recovery rate of this method was satisfied in experiments of adding 2≈500 ppm calcium to 1≈4 grams of high purity sodium. The relative standard deviation was at 5.3%≈7.2%. The possible loss of calcium and its compound resulting from distillation had been investigated. The interference and suppressing methods were also studied.

7041 (CONF-9111129–4) **Detection of explosives material on single microparticles.** Whitten, W.B.; Dale, J.M.; Ramsey, J.M. Oak Ridge National Lab., TN (United States). [1991]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From FAA explosives detection symposium; Atlantic City, NJ (United States); 13-15 Nov 1991. Order Number DE92004408. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Some of the explosive materials with very low vapor pressure such as RDX or PETN are most likely to be encountered either as solids or adsorbed on solids. We are developing a new technique for the chemical characterization of explosives-bearing microparticles based upon the use of electrodynamic traps. Single microparticles are analyzed by laser ablation mass spectrometry in an ion trap detector. 8 refs., 2 figs.

7042 (DOE/ER/13463–8) **Novel macrocyclic carriers for proton-coupled liquid membrane transport: Progress report, 1 December 1988–31 May 1991.** Lamb, J.D. Brigham Young Univ., Provo, UT (United States). 10 Jun 1991. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER13463. Order Number DE92004045. Source: OSTI; NTIS; GPO Dep.

The objective of our research program is to elucidate the chemical principles which are responsible for the cation selectivity and permeability of liquid membranes containing macrocyclic carriers. Several new macrocyclic carriers were synthesized during the last three year period, including selenium-containing macrocycles, new crown-4 structures, and several new crown structures containing nitrogen based heterocycles as substituents in the principal macrocyclic ring. The cation binding properties of these macrocycles were investigated by potentiometric titration, calorimetric titration, solvent extraction, and NMR techniques. In addition, hydrophobic macrocycles were incorporated into dual hollow fiber membrane systems to investigate their membrane performance, especially in the proton-coupled transport mode. It was found that the dual hollow fiber system maintains the cation selectivity and permeability of supported liquid membranes, while enhancing membrane stability. The diffusion limited transport model was expanded to account for membrane solvent effects. Furthermore, Eu^{2+} transport was found to be similar to that of strontium and much higher than that of the lanthanides, in supported liquid membrane systems.

7043 (DOE/ER/13649–5) **Mechanisms of gas permeation through polymer membranes: Summary technical report, September 1989–August 1991.** Stern, S.A. Syracuse Univ., NY (United States). Dept. of Chemical Engineering and Materials Science. [1991]. 28p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER13649. Order Number DE92004423. Source: OSTI; NTIS; GPO Dep.

The objective of the present study is to investigate the mechanisms of gas transport in and through polymer membranes and the dependence of these mechanisms on pressure and temperature. This information is required for the development of new, energy-efficient membrane processes for the separation of industrial gas mixtures. Such processes are based on the selective permeation of the components of gas mixtures through nonporous polymer membranes. Recent work has been focused on the permeation of gases through membranes made from glassy polymers, i.e., at temperatures below the glass transition of the polymers (Tg). Glassy polymers are very useful membrane materials for gas separations because of their high selectivity toward different gases. Gases permeate through nonporous polymer membranes by a "solution-diffusion" process. Consequently, in order to understand the characteristics of this process it is necessary to investigate also the mechanisms of gas solution and diffusion in glassy polymers. 23 refs., 10 figs., 4 tabs.

7044 (DOE/ER/14056–10) **The influence of pressure on solute retention in liquid chromatography.** McGuffin, V.L.; Evans, C.E. Michigan State Univ., East Lansing, MI (United States). Dept. of Chemistry. [1991]. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-89ER14056. (CONF-9105293–1: International symposium on capillary chromatography, Riva del Garda (Italy), 13-16 May 1991). Order Number DE92004017. Source: OSTI; NTIS; GPO Dep.

In this investigation, multiple on-column detectors are utilized to measure the retention of model solutes directly on a packed, capillary column. The absolute pressure on the column is controlled using a restrictor at the column exit, while the pressure gradient and volumetric flowrate are maintained constant. Measurements obtained under reversed-phase conditions indicate that the local capacity factor changes considerably with local pressure under typical operating conditions. These results are somewhat surprising since the mobile-phase solvents used for liquid chromatography are generally considered to be incompressible.

7045 (DOE/ER/60648–4) **[Clusters: Elucidating the dynamics of ionization events and ensuing reactions in the condensed phase]: Brief summary of accomplishments.** Castleman, A.W. Jr. Pennsylvania State Univ., University Park, PA (United States). [1991]. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER60648. Order Number DE92004416. Source: OSTI; NTIS; GPO Dep.

New insight into a variety of phenomena of interest in liquids have been derived from recent studies in our laboratory. In particular, new findings have contributed to identifying the structure of protonated complexes among species of varying proton affinities, and quantifying the variations in spectroscopic properties of chromophores as influenced by solvation and aggregation. 17 refs.

7046 (INIS-BR–2851) **Neptunium separation in trace levels from uranium solutions by extraction chromatography.** Figols, M.E.B. Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, SP (Brazil). 1991 103p. (In Portuguese). Order Number DE92613318. Source: OSTI; NTIS (US Sales Only); INIS.

Neptunium and uranium behavior in extraction chromatography system, aiming the separation of microquantities of neptunium from uranyl nitrate solutions is described. Tri-n-octylamina (TOA), tri-n-butylphosphate (TBP), thenoyltrifluoroacetone (TTA) as stationary phase, alumina, Voltalef-UF-300, silica as support material were verified. The impregnation conditions as well as the best stationary phase/support material ratio were established. TBP/alumina, TBP/Voltalef and TOA/alumina system were selected to uranium and neptunium separation studies. In the system using TBP as extractant agent uranium and neptunium separation was reached by selective elution after the retention of both elements on the column. U-Np separation by selective retention of Np was possible with TOA system. The capacity of the column was the 66.6 mg U/mL and 191.6mg U/mL for the TBP/alumina and TBP/Voltalef systems, respectively. An application of extraction chromatography system in the final phase of irradiated uranium treatment process is proposed. (author).

7047 (INIS-mf–13025 vp.) **Methods for analysis of uranium-plutonium mixed fuel and transplutonium elements at RIAR (Preprint no. IT-25).** Timofeev, G.A. (V.I. Lenin Research Institute of Atomic Reactors, Dimitrovgrad (USSR)). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. Feb 1991. 685p. (CONF-9102132–: International symposium on radiochemistry and radiation chemistry - plutonium 50, Bombay (India), 4-7 Feb 1991). In *International sumposium on radiochemistry and radiation chemistry (Plutonium - 50 years) (held at Bombay during February 4-7, 1991): Preprints volume.* Order Number DE92001334. Source: OSTI; NTIS (US Sales Only); INIS.

Different methods for analysis of the uranium-plutonium mixed nuclear fuel and transplutonium elements are briefly discussed in this paper: coulometry, radiometric techniques, emission spectrography, mass-spectrometry, chromatography, spectrophotometry. The main analytical characteristics of the methods developed are given. (author). 30 refs., 2 tabs.

7048 (INIS-mf–13025 vp.) **Analytical chemistry of plutonium (Preprint no. IT-26).** Jain, H.C. (Bhabha Atomic Research Centre, Bombay (India). Fuel Chemistry Division). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. Feb 1991. 685p. (CONF-9102132–: International symposium on radiochemistry and radiation chemistry - plutonium 50, Bombay (India), 4-7 Feb 1991). In *International symposium on radiochemistry and radiation chemistry (Plutonium - 50 years) (held at Bombay during february 4-7, 1991): Preprints volume.* Order Number DE92001334. Source: OSTI; NTIS (US Sales Only); INIS.

Analytical chemistry of plutonium encompasses different aspects e.g. solution chemistry, solid state chemistry, nuclear chemistry and methods for its determination. In this paper, the determination of plutonium which is one of the important aspects of analytical chemistry is dealt with. This involves the determination of isotopic composition and concentration/amount of plutonium at different levels in a variety of matrices. Because of its strategic importance, highly toxic nature, and also from the criticality point of view, sensitive, precise and accurate methods are essential. The selection of the method is governed by the type of matrix, the amount of plutonium present and the precision and accuracy requirements. This paper reviews the different methodologies available for these measurements with emphasis on the work performed in author's laboratory. (author). 40 refs.

7049 (INIS-mf–13026, pp. 343-344) **Analysis of Fe and Ti based alloys for zirconium content by 14 MeV NAA.** Pansare, G.R. (Poona Univ., Pune (India). Dept. of Physics); Dighe, P.M.; Bhoraskar, V.N. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ZIRCONIUM/neutron activation analysis; ALPHA PARTICLES; ALUMINIUM 27 TARGET; HIGH-PURITY GE DETECTORS; IRON BASE ALLOYS; MEV RANGE

10-100; NEUTRON REACTIONS; NEUTRONS; SODIUM 24; TITANIUM BASE ALLOYS; ZIRCONIUM; ZIRCONIUM 90; ZIRCONIUM 90 TARGET

7050 (INIS-mf–13065) **Fluorescence of UO_2^{2+} in different acidic media containing cationic and anionic impurities. Application to the elaboration of a very sensitive dosing method of Uranium in solution by fluorimetry and to the study of the kinetics of U-6 reduction by iron.** Belkadi, L. (Universite Mohammed 5, Rabat (Morocco). Faculte des Sciences). Universite Mohammed 5, Rabat (Morocco). Faculte des Sciences. Sep 1990 138p. (In French). Order Number DE92614750. Source: OSTI; NTIS (US Sales Only); INIS.

The use of the fluorimetric analysis method in phosphoric medium proved that this method is very sensitive for detecting Uranium traces (10 E-10 M). The dosing can be carried out after a simple calibration of the device and without calling for the addition techniques. The interference of most organic matters is eliminated by the 337 nm exciting radiation. The inhibition of the fluorescence induced by anions and cations is generally resolved by a simple dilution. The nitrates that have a harmful effect on the Uranium fluorescence have been eliminated by successive evaporations. This method, as it has been improved in this work, is applied to the study of U-6 reduction by metallic Iron and Fe-2 in orthophosphoric acid medium in case the absorption spectrophotometry becomes inoperative. 37 figs., 14 tabs., 50 refs. (author).

7051 (IPEN-PUB–340) **Isotopic analysis of boron by thermal ionization mass spectrometry.** Kakazu, M.H.; Sarkis, J.E.S.; Souza, I.M.S. Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, SP (Brazil). Jul 1991. 32p. (In Portuguese). Order Number DE92613308. Source: OSTI; NTIS (US Sales Only); INIS.

This paper presents a methodology for isotopic analysis of boron by thermal ionization mass spectrometry technique through the ion intensity measurement of $Na_2BO^+_2$ in H_3BO_3, B^o and B_4C. The samples were loaded on single tantalum filaments by different methods. In the case of H_3BO_3, the method of neutralization with NaOH was used. For B_4C the alcaline fusion with Na_2CO_3 and for B^o dissolution with 1:1 nitric sulfuric acid mixture followed by neutralization with NaOH was used. The isotopic ratio measurements were obtained by the use of s Faraday cup detector with external precision of ±0,4% and accuracy of ±0,1%, relative to H_3BO_3 isotopic standard NBS 951. The effects of isotopic fractionation was studied in function of the time during the analyses and the different chemical forms of deposition. (author).

7052 (IS-T–1605) **New chelating reagents for preconcentration, separation, determination of metal complexes by high performance liquid chromatography and solid phase extraction.** Qian, Yan wen. Ames Lab., IA (United States). 3 Dec 1991. 60p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. Order Number DE92005153. Source: OSTI; NTIS; GPO Dep.

A general scheme is outlined for rapid determination of metal cations by complexation and subsequent HPLC separation. The synthesis and general properties are described for several new thiohydrazone chelating reagents. Solubility considerations suggest that the metal complexes have a positive charge. Excellent chromatographic separations are obtained for mixtures of up to seven metal complexes. Addition of a positively charged additive to the eluent is shown to have a significant effect on both the retention times and sharpness of the chromatographic peaks. Separation of the metal complexes on resins with a permanent charge is also shown to be feasible. Two new hydrazone reagents have been synthesized and characterized. Trace metal ions in aqueous solution are complexed by one of the hydrazones and the resulting metal complexes are solid phase extracted onto a mini cation-exchange or polymeric column. The uptake of metal complexes is complete and the elution step is fast and complete. The quantitative recoveries of metal ions determined by both spectrophotometric method and ICP-MS are very satisfactory and agree with each other.

7053 (KAERI-II/RR–11/90) **Basic chemistry for radioactive waste management: Development of chemical methods on geological material analysis.** Eom, Tae Yoon (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Suh, Moo Yul; Joe, Kih Soo; Chung, Yong Sam; Kim, Jung Suk; Sohn, Se Chul; Han, Sun Ho; Jee, Kwang Yong; Choi, Kwang Soon; Lee, Chang Heon. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Mar 1991. 146p. (In Korean). Order Number DE92614572. Source: OSTI; NTIS (US Sales Only); INIS.

Chemical analysis methods on geological materials were investigated for the evaluation of radioactive waste disposal site, and the scope and contents weer as follows: -Determination of the major and trace elements in granite rocks by ICP-AES and INAA: Experimental conditions of ICP-AES and INAA were established with geological standard rock, USGS-G2. The ICP-AES was found to be better both in precision and in accuracy than the INAA for major elements. The precision and the accuracy of the ICP-AES method were about 6% and +/- 10%, respectively. -Determination of inorganic and organic anions by ion chromatography and prediction of retention times : Analytical methods for inorganic anions was established with NaOH eluents by ion chromatography. Studies on the prediction of retention times of the anions for gradient elution was carried out using the stepwise elution equation. The slope from the plot of log K' against log $[OH^-]$ was obtained by a linear regression, and a good agreement was obtained between the experimental and the calculated values. -Development of analytical methods for the determination of Co, Ni and In by differential-pulse adsorptive stripping voltametry and ferrous and ferric ions by spectrometry : Detection limits of Co, Ni and In were 0.02, 0.05 and 0.2 ppb, respectively, and the content of ferrous and ferric ion in KAERI ground water were 0.12 and 0.08 ppm respectively. -Determination of trace uranium in groundwaters by neutron activation analysis : Uranium in KAERI groundwater was preconcentrated on the chelating resin, Chelex-100 and the uranium content was measured by neutron activation analysis. The analytical result was 4.5 ppb with standard deviation of 0.049. (Author).

7054 (MAFF-AEPAM–7) **The determination of alpha-emitting nuclides of plutonium, americium and curium in environmental materials: Pt. 1: Sea water.** Lovett, M.B.; Boggis, S.J.; Blowers, P. Ministry of Agriculture, Fisheries and Food, Lowestoft (United Kingdom). Directorate of Fisheries Research. 1990. 36p. Order Number DE92614732. Source: OSTI; NTIS (US Sales Only); INIS.

Within the Aquatic Environment Protection Division of the Directorate of Fisheries Research (DFR), the Radioanalytical Group routinely analyses a wide range of environmental materials for a substantial number of radionuclides. A wide variety of radiochemical procedures have been developed at different laboratories but there are no 'standard' methods because the methods are continually developing. Nevertheless, it is useful, as in this present series, periodically to draw together the methods which are in routine use at a laboratory and to discuss their development and application. (author).

7055 (ORNL/M–1223) **Analytical mass spectrometry: Abstracts.** Oak Ridge National Lab., TN (United States). [1990]. 53p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. (CONF-900725–Absts.: 43. annual summer symposium on analytical chemistry, Oak Ridge, TN (United States), 24-27 Jul 1990). Order Number DE92004043. Source: OSTI; NTIS; GPO Dep.

This 43rd Annual Summer Symposium on Analytical Chemistry was held July 24–27, 1990 at Oak Ridge, TN and contained sessions on the following topics: Fundamentals of Analytical Mass Spectrometry (MS), MS in the National Laboratories, Lasers and Fourier Transform Methods, Future of MS, New Ionization and LC/MS Methods, and an extra session. (WET)

7056 **A backscattering spectrometry device for identifying unknown elements present in a workpiece.** Doyle, B.L.; Knapp, J.A. To Dept. of Energy. 1990. Filed date 30 May 1990. USA Patent patent application 7-530,672. 17p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE92004621. Source: OSTI; NTIS; GPO Dep.

This invention is comprised of a backscattering spectrometry method and device for identifying and quantifying impurities in a workpiece during processing and manufacturing of that workpiece. While the workpiece is implanted with an ion beam, that same ion beam backscatters resulting from collisions with known atoms and with impurities within the workpiece. Those ions backscatter along a predetermined scattering angle and are filtered using a self-supporting filter to stop the ions with a lower energy because they collided with the known atoms of the workpiece of a smaller mass. Those ions which pass through the filter have a greater energy resulting from impact with impurities having a greater mass than the known atoms of the workpiece. A detector counts the number and measures the energy of the ions which pass through the filter. From the energy determination and knowledge of the scattering angle, a mass calculation determines the identity, and from the number and solid angle of the scattering angle, a relative concentration of the impurity is obtained.

7057 **Apparatus and method for separating constituents.** Maronde, C.P.; Killmeyer, R.P. Jr. To Dept. of Energy. 1990. Filed date 25 Jun 1990. USA Patent patent application. 25p. Sponsored by U.S. DOE Fossil Energy. Order Number DE92003814. Source: OSTI; NTIS; GPO Dep.

A centrifugal separator apparatus and method for improving the efficiency of the separation of constituents in a fluid stream. A cyclone separator includes an assembly for separately discharging both constituents through the same end of the separator housing. A rotary separator includes a rotary housing having a baffle disposed therein for minimizing the differential rotational velocities of the constituents in the housing, thereby decreasing turbulence, and increasing efficiency. The intensity of the centrifugal force and the time which the constituents reside within the housing can be independently controlled to improve efficiency of separation. 4 figs.

7058 (POEF-T-3581-Extd.Abst.) **Determination of uranium and uranium isotopes in mixed and radioactive wastes by inductively coupled plasma-mass spectrometry.** Taphorn, J.E.; Mayfield, K.C.; Vita, O.A. Portsmouth Gaseous Diffusion Plant, OH (United States). 2 Dec 1991. 4p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-76OR00001. (CONF-920302-1-Extd.Abst.: 43. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy, New Orleans, LA (United States), 9-13 Mar 1992). Order Number DE92003981. Source: OSTI; NTIS; INIS; GPO Dep.

This work reports on the efforts to develop methods for sample dissolution and chemical separation, as well as analytical methodology for the analysis of both total uranium and its isotopes in differing waste sample matrices.

7059 (SAND-91-8703) **Infrared degenerate four-wave mixing as a diagnostic.** Vander Wal, R.L. (Sandia National Labs., Livermore, CA (United States)); Farrow, R.L.; Rakestraw, D.J.; Holmes, B.E.; Jeffries, J.B.; Danehy, P.M. Sandia National Labs., Livermore, CA (United States). [1991]. 4p. Sponsored by U.S. DOE Conservation & Renewable Energy; U.S. DOE Energy Research. DOE Contract AC04-76DR00789. Order Number DE92005331. Source: OSTI; NTIS; GPO Dep.

We are currently exploiting the recently realized spectroscopic capabilities of degenerate four-wave mixing (DFWM) to probe key combustion species by employing infrared rovibrational transitions to achieve resonant enhancement.

7060 (UCRL-CR-108120) **Enhancing sample preparation capabilities for accelerator mass spectrometry radiocarbon and radiocalcium studies.** Taylor, R.E. (California Univ., Riverside, CA (United States)). Lawrence Livermore National Lab., CA (United States); California Univ., Riverside, CA (United States). 20 Aug 1991. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE92003966. Source: OSTI; NTIS; INIS; GPO Dep.

With support provided by the LLNL Accelerator Mass Spectrometry Laboratory, the UCR Radiocarbon Laboratory continued its studies involving sample pretreatment and target preparation for both AMS radiocarbon (^{14}C) and radiocalcium (^{41}Ca) involving applications to archaeologically – and paleoanthropologically- related samples. With regard to AMS ^{14}C-related studies, we have extended the development of a series of procedures which have, as their initial goal, the capability to combust several hundred microgram amounts of a chemically-pretreated organic sample and convert the resultant CO_2 to graphitic carbon which will consistently yield relatively high $^{13}C^-$ ion currents and blanks which will yield, on a consistent basis, ^{14}C count rates at or below 0.20% modern, giving an 2 sigma age limit of >50,000 yr BP.

7061 (ZfK-746) **Construction and testing of probes for oxygen measurement in steel melts.** Richter, W. (Zentralinstitut fuer Kernforschung, Rossendorf (Germany)); Zitzmann, H.; Ullmann, H.; Kirchhoff, H. Zentralinstitut fuer Kernforschung, Rossendorf (Germany). Jul 1991. 30p. (In German). Order Number DE92750166. Source: OSTI; NTIS (US Sales Only).

The Central Institute of Nuclear Research (ZfK) Rossendorf developed oxygen probes for measurements in steel melts in cooperation with industrial plants and participated in their production and testing. The steps of investigation and development of the oxygen probes were development of ceramics, assembling of the sensor, and manufacturing of oxygen probes. In the result of the development a MgPSZ-ceramics was obtained which met all requirements for application in steel melts (strength, thermal shock resistence). The reference mixture applicated in this sensor distinguishes by a rapid potential formation. The oxygen sensors were tested in laboratory melts whereas the complete oxygen probes were operated in steel plants. The general measuring behaviour of the sensors could be demonstrated in the laboratory tests. The quantitative determination of the measuring parameters was obtained by comparative measurements in steel plants. The determination of high oxygen activities causes no troubles and the standard deviation of the cell voltage was within a ±6 mV range. At lower oxygen activities the measurements showed greater differences and require further improvement. (orig.).

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Refer also to citation(s) 6120, 6121, 6171, 6176, 6190, 6193, 6223, 6227, 6311, 6642, 6866, 6926, 7037, 7043, 7045, 7101, 7135, 8144

7062 (ANL/CP-72789) **Oxo chemistry in supercritical carbon dioxide.** Krause, T.R.; Rathke, J.W.; Klingler, R.J. Argonne National Lab., IL (United States). [1991]. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-911133-9: American Institute of Chemical Engineers (AIChE) annual meeting, Los Angeles, CA (United States), 17-22 Nov 1991). Order Number DE92004128. Source: OSTI; NTIS; GPO Dep.

We report an investigation of the cobalt carbonyl-catalyzed oxo process in supercritical CO_2 using in situ high pressure NMR spectroscopy. The use of supercritical CO_2 as the solvent medium eliminates gas-liquid mixing problems. The effect of supercritical CO_2 on the oxo reaction was determined by comparing the linear to branched aldehyde yield and rate and other equilibrium processes involved in the catalytic cycle with measured values in conventional liquid solvents.

7063 (ANL/CP-73404) **Structures and stabilities of trivalent and tetravalent rare earth ions in sevenfold and eightfold coordination in fluorite-related complex oxides.** Morss, L.R. Argonne National Lab., IL (United States). [1991]. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-911109-6: Fall meeting of the European Materials Research Society, Strasbourg (France), 5-8 Nov 1991). Order Number DE92005237. Source: OSTI; NTIS; GPO Dep.

This paper reports the preparation and characterization of a series of oxides containing 3+ or 4+ lanthanide (M = Ce, Pr, or Tb) ions, with different ionic sizes and varying M^{4+}/M^{3+} reduction potentials, in nearly cubic coordination. The objective of the study was to demonstrate how oxidation-reduction characteristics and ionic size trends explain the properties of these oxides and to compare the oxidation-reduction stability of M^{3+} and M^{4+} lanthanide ions in high (CN 7 or 8) coordination in fluorite-related oxides versus low (CN 6) coordination in perovskite oxides. Efficient preparative methods are reported, as well as powder diffraction and thermogravimetric measurements for oxides $CaMTi_2O_{7-x}$ and $CaMZr_2O_{7-x}$. These oxides were characterized by X-ray powder diffraction and by thermogravimetric analysis. $CaCeTi_2O_7$ is a pyrochlore, a = 10.142(4) Å, with Ce^{4+} much more easily reducible than in the perovskite $BaCeO_3$. By contrast, a preparation with the stoichiometry "$CaPbTi_2O_{7-x}$" is a two-phase mixture-of perovskite $CaTiCo_3$ and a presumably Pr^{3+}-rich pyrochlore $Pr_2Ti_2O_7$(?). $CaTbTi_2O_{7-x}$ appears to be a Tb^{3+} pyrochlore, a = 10.149(2) Å. $CaCeZr_2O_7$ is a pyrochlore, a = 10.524(1) Å. A preparation of "$CaPbZr_2O_{7-x}$" also appeared to yield a two-phase mixture, perovskite $CaZrO_3$ and pyrochlore $Pr_2Zr_2O_7$. In this paper, the structures, f-element ion sites, and M(4)-M(3) stability trends in the $CaMTi_2O_{7-x}$ and $CaMZr_2O_{7-x}$ oxides are compared with the structural and stability trends in the perovskites $BaMO_3$ which have M^{4+} ions in sixfold (tilted octahedra) coordination.

7064 (ANL/CP–74763) **Enthalpies of formation of rare earths and actinide(III) hydroxides: Their acid-base relationships and estimation of their thermodynamic properties.** Morss, L.R.; Williams, C.W. Argonne National Lab., IL (United States). [1991]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-911109–7: Fall meeting of the European Materials Research Society, Strasbourg (France), 5-8 Nov 1991). Order Number DE92005235. Source: OSTI; NTIS; GPO Dep.

This paper reviews the literature on rare earth(III) and actinide(III) hydroxide thermodynamics, in particular the determination of their enthalpies of formation at 25°C. The hydroxide unit-cell volumes, lanthanide/actinide ion sizes, and solid-solution stability trends have been correlated with a generalized acid-base strength model for oxides to estimate properties for heterogeneous equilibria that are relevant to nuclear waste modeling and to characterization of potential actinide environmental interactions. Enthalpies of formation and solubility-product constants of actinide(III) hydroxides are estimated.

7065 (BNL–47044) **Rotationally resolved threshold photoionization of H_2S.** Wiedmann, R.T.; White, M.G. Brookhaven National Lab., Upton, NY (United States). [1991]. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-920124–2: Society of Photo-Optical Instrumentation Engineers' international symposium on laser spectroscopy as part of SPIE's symposium on optics, electro-optics and laser applications in science and engineering, Los Angeles, CA (United States), 19 Order Number DE92005046. Source: OSTI; NTIS; INIS; GPO Dep.

With the recent development of zero kinetic energy threshold photoelectron spectroscopy (ZEKE-PES) it is now possible to take advantage of the high resolution capabilities of laser radiation and measure the rotational distributions of many small cations produced via photoionization. We have used threshold photoelectron spectroscopy in conjunction with a VUV laser source to probe the rotational distributions of several molecular cations following one-photon VUV photoionization. Spectra are obtained by the delayed, pulsed field ionization (PFI) method which is a variant of the ZEKE-PES technique. In this paper, we report on the rotationally-resolved threshold photoelectron spectra of the non-linear triatomic H_2S. These measurements are an extension of our earlier study on H_2O which provided the first look at the symmetry properties of allowed rotational transitions in the photoionization of non-linear molecules.

7066 (CONF-911270–1) **Project summary: Physical chemistry of geothermal systems.** Mesmer, R.E.; Cole, D.R.; Holmes, H.F.; Palmer, D.A.; Simonson, J.M.; Wesolowski, D.J. Oak Ridge National Lab., TN (United States). [1991]. 25p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From Geothermal energy peer review; Salt Lake City, UT (United States); 4 Dec 1991. Order Number DE92004342. Source: OSTI; NTIS; GPO Dep.

We have completed solubility studies on gibbsite to 100°C in several electrolyte media and derived speciation of Al^{3+} in solution; defined the ionization constant for HSO_4 at 250°C in brine compositions to 5 molal and completed measurements of the ion-interaction parameters for $NaHSO_4$(aq) to 250°C; measured volatility of HCl over aqueous HCl to 350°C and applied derived model to the conditions of the Geysers; and completed measurements of the effects of NaCl and KCl on D/H and $^{18}O/^{16}O$ liquid-vapor partitioning are complete to 100°C and to 6 molal. Studies on the effects of $MgCl_2$ and $CaCl_2$ and their mixtures are underway.

7067 (DOE/ER/13323–6) **Highly nucleophilic acetylide, vinyl, and vinylidene complexes: Progress report.** Pennsylvania State Univ., University Park, PA (United States). Dept. of Chemistry. 1 Aug 1991. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-85ER13323. Order Number DE92003751. Source: OSTI; NTIS; GPO Dep.

In the past year we have completed our studies of the halide-promoted carbonylation of imido ligands, extended our explorations of Cp(CO)(L)Mn-X complexes which possess highly reactive acetylide, vinylidene, carbyne, and vinylcarbyne ligands, and have briefly investigated the formation of bimetallic complexes using anionic carbene complexes. 5 figs.

7068 (DOE/ER/13507–7) **Synthesis and analysis of novel polymers with high permselectivity and permeability in gas separation applications: Progress report, December 1990–November 1991.** Koros, W.J.; Paul, D.R. Texas Univ., Austin, TX (United States). Dept. of Chemical Engineering. 15 Nov 1991. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-86ER13507. Order Number DE92004057. Source: OSTI; NTIS; GPO Dep.

We have synthesized and completed characterization of permeability and selectivity properties of a group of polysulfones and polyether ketones with the potential for higher use temperatures, as well as members of a series of polyesters derived from spirobiindane bisphenol monomer in conjunction with meta and para substituted diacid chlorides. We have also synthesized and characterized the gas transport and thermal properties of diphenyl substituted polyphenylene oxide. The diphenyl substituted material has a potential for higher temperature applications than the standard dimethyl substituted polymer. The temperature dependence of the gas transport properties for the oxygen/nitrogen system was characterized over the range from 35 to 65°C for both of these analog materials.

7069 (DOE/ER/13514–T1) **Synthesis and chemistry of yttrium and lanthanide metal complexes: Progress report, March 15, 1991–March 14, 1992.** Evans, W.J. California Univ., Irvine, CA (United States). Dept. of Chemistry. Sep 1991. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract FG03-86ER13514. Order Number DE92003767. Source: OSTI; NTIS; GPO Dep.

The objective of this research project is to determine the special features of complexes of yttrium and the lanthanide metals which will allow the design and synthesis of materials with unique chemical, physical, and catalytic properties. Past studies of yttrium and lanthanide metal alkyl and hydride complexes stabilized by cyclopentadienyl co-ligands have shown that a substantial, often singular, organometallic chemistry is available via these metals. More extensive utilization of the chemical opportunities available through yttrium and the lanthanides would be possible, however, if stabilizing ancillary ligand systems less sensitive to oxidation and protonolysis than cyclopentadienides could be developed. Alkoxide ligands are attractive in this regard and our recent research had focused on alkoxides and the special opportunities they can provide to these metals. 6 refs., 10 figs.

7070 (DOE/ER/13766–9) **Reactions of metal ions and their clusters in the gas phase using laser ionization–Fourier transform mass spectrometry: Progress report, February 1, 1990–January 31, 1991.** Freiser, B.S. Purdue Univ., Lafayette, IN (United States). Dept. of Chemistry. Sep 1990. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER13766. Order Number DE92005340. Source: OSTI; NTIS; GPO Dep.

Carbon clusters of the form C_N^- are observed at least out to N = 30 confirming that cluster formation is occurring in the high pressure "waiting room" of the supersonic cluster source. This can be stated unequivocally, since only up to N = 13 is observed by direct laser desorption of a carbon target in the absence of supersonic expansion. Currently underway is a systematic investigation of a wide variety of M^+-C_nH_{2n} species with n = 2–10 and M = first and second row transition metal ions. In addition we will shortly apply this methodology to doubly charged ions and metal cluster ions. All indications are that this area will be highly productive.

7071 (DOE/ER/13775–4) **[Comparison of group transfer, inner shere and outer sphere electron transfer mechanisms for organometallic complexes]: Summary.** State Univ. of New York, Buffalo, NY (United States). [1991]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER13775. Order Number DE92004068. Source: OSTI; NTIS; GPO Dep.

Our studies of reactions of metal carbonyl cations and anions have shown that metal carbonyl cations can catalyze CO exchange reactions on metal carbonyl anions. This result provides further evidence for a mechanism involving attack of the metal carbonyl anion on a carbon of the metal carbonyl cation in CO^{2+} transfer reactions. Reaction of metal carbonyl anions with metal carbonyl halides is a common approach to formation of metal-metal bonds. We have begun to use kinetic data and product analysis to understand the formation of homobimetallic versus heterobimetallic products in such reactions. Initial data indicate a nucleophilic attack, possibly through a ring-slippage mechanism.

7072 (DOE/ER/13809–T1) **Investigations of charge-separation processes in metal complexes: Performance report.** Crosby, G.A. Washington State Univ., Pullman, WA (United States). 18 Feb 1991. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-87ER13809. Order Number DE92004327. Source: OSTI; NTIS; GPO Dep.

The major thrust of the research has been the quantification of the excited states of inorganic complexes that display potential for mediating charge-separation processes. Investigations of copper(1) mixed-ligand complexes have been completed. Non-equilibrated emitting states have been assigned. Chemical tuning of the emission energy by modifying the basicity of the donor ligand on the metal has been achieved. Structure-property relationships have been defined for crystalline complexes of zinc containing both diimine and monothiol ligands. Correlation of the spectral shifts with the rotations of the thiol phenyl rings in different crystal phases has been shown by comparing with extended Huckel calculations and x-ray structures. Complexes of zinc containing diimine and dithiol ligands are shown to be polynuclear species. A trinuclear species can be forced to assume a binuclear structure by incorporating other non-coordinating ligands into the lattice. The transformation is accompanied by substantial photophysical changes. Syntheses and x-ray structure determinations of platinum(2) complexes containing diimine ligands only, both diimine and dithiol ligands, and dithiol ligands only have been completed. An unusual platinum(3) bis(dithiol) species has been obtained and its structure determined. Investigations of the emission spectra of bis(bipyridine)platinum(2) have revealed the existence of multiple emitting states with both ligand-localized and charge- transfer characteristics.

7073 (DOE/ER/13855–5) **Preparation of polymer-modified electrodes: A literature and experimental study.** Jayanta, P.S.; Ishida, Takanobu. State Univ. of New York, Stony Brook, NY (United States). Dept. of Chemistry. May 1991. 99p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER13855. Order Number DE92005304. Source: OSTI; NTIS; GPO Dep.

Thesis submitted by Pat Siripastr Jayanta.

A literature review is presented on the field of polymer modified electrodes which can be electrochemically generated. It is suggested that a possible application of these polymer modified electrodes is as a regeneratable catalysis packing material for use in couter-current exchange columns. Secondly, there is a presentation of experimental results dealing with possible electrode modification using difluoro- and dimethyl- phenols and fluorinated derivatives of styrene, benzoquinone and hydroquinone. It appears that dimethylphenol shows the most potential of the monomers experimentally tested in providing a stable polymer modified electrode surface. 170 refs., 31 figs., 1 tab.

7074 (DOE/ER/13880–4) **Late transition metal oxo and imido complexes: Progress report, May 15, 1991–May 14, 1992.** Sharp, P.R. Missouri Univ., Columbia, MO (United States). Dec 1991. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER13880. Order Number DE92005079. Source: OSTI; NTIS; GPO Dep.

Novel, electrophilic ring addition reactions and oxidative ring coupling reactions have been discovered for aryl-imido A-frame rhodium complexes. Probable transient radical intermediates are produced and detected by electrochemical oxidation. The $[L_2PtO]_2$ class of dioxo complexes has been expanded to include the chelating ligands, $L_2 = Ph_2P(CH_2)_nPPh_2$ (n=1–4). $[(Ph_2P(CH_2)_nPPh_2)PtO]_2$ shows the greatest reactivity suggesting a dependence on the P-Pt-P angle. Mixed-metal complexes where the oxo groups in $[L_2PtO]_2$ are used as ligands for other metals have been prepared and show a dramatic cooperative effect in their reactions with carbon monoxide. New hydrazido complexes of Au(I) have been prepared. Their decompositions provide new routes and mechanistic insight into the formation of gold clusters.

7075 (DOE/ER/13935–3) **Synthesis and chemistry of cationic d^0 metal alkyl complexes: Progress report, July 1988–May 1991.** Jordan, R.F. Iowa Univ., Iowa City, IA (United States). Dept. of Chemistry. [1991]. 29p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER13935. Order Number DE92005300. Source: OSTI; NTIS; GPO Dep.

The objective of this project is to develop new types of electrophilic metal alkyl complexes for catalytic C-H activation and olefin polymerization chemistry, and associated fundamental mechanistic studies. We have focused our efforts on four classes of early metal alkyl complexes: (1) cationic group 4 $Cp_2M(R)^+$ complexes (1) which are active species in Cp_2MX_2-based Ziegler-Natta olefin polymerization catalyst systems and which catalyze productive C-H activation reactions of heterocycles, (2) neutral (dicarbollide)(Cp*)M(R) complexes (2) which are structurally are electronically very similar to 1, (3) half-sandwich complexes $CpM(R)_2(L)_n^+$ which are highly coordinatively and electronically unsaturated, and (4) new group 5 (dicarbollide)(Cp)MR_2 and $(dicarbollide)_2$ MR complexes which are more unsaturated than group 5 Cp_2M systems due to incorporation of the dicarbollide ligand.

7076 (DOE/ER/13945–3) **High temperature chemistry of aromatic hydrocarbons.** Scott, L.T. Nevada Univ., Reno, NV (United States). [1991]. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract FG08-88ER13945. Order Number DE92005305. Source: OSTI; NTIS; GPO Dep.

We have not only gained new insight into the mechanism and generality of Polycyclic Aromatic Hydrocarbon (PAH) thermal automerization reactions, we have also uncovered several new high temperature reactions and added a third dimension to our program by applying high temperature chemistry to problems in organic synthesis. Our synthesis of corannulene has attracted much recent attention; however, we believe that the uncatalyzed "cyclodehydrogenation reactions" which form 5-membered rings and 6-membered rings at high temperatures may prove to be of greater general importance in the long term. This bias is reflected in the accompanying proposal.

7077 (DOE/ER/14117–T1) **Chemistry of bimetallic and alloy surfaces: Progress report, June 1, 1990–November 30, 1991.** Koel, B.E. University of Southern California, Los Angeles, CA (United States). Dept. of Chemistry. 18 Oct 1991. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract FG03-90ER14117. Order Number DE92003762. Source: OSTI; NTIS; GPO Dep.

In the first funding period, we continued our work on elucidating the underlying principles that govern chemical reactions occurring on bimetallic and alloy surfaces. Our goal is to aid in the atomic level explanation of the reactivity and selectivity of alloy and bimetallic cluster catalysts and to provide a fundamental basis for the design of new catalysts with improved performance. Our approach is to use a battery of surface science methods to obtain fundamental data on the thermochemistry and kinetics of the adsorption and reaction of molecules on extensively characterized, single-crystal bimetallic surfaces. We measure changes in chemisorption bond strengths, adsorption site distributions, and hydrocarbon fragment stability and reactivity and correlate these results with the geometric and electronic structure of the metal atoms on the surface. Often, our aim is to carefully design experiments that isolate the several factors (e.g., ensemble and ligand effects) that control surface chemistry and catalysis on bimetallic and alloy surfaces in order to better understand the importance of each contribution. Some of the highlights and noteworthy accomplishments made during the first period of this grant are given.

7078 (DOE/ER/14117–T2) **Chemistry of bimetallic and alloys surfaces: Progress report, June 1, 1990–November 30, 1991.** Koel, B.E. University of Southern California, Los Angeles, CA (United States). Dept. of Chemistry. 18 Oct 1991. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract FG03-90ER14117. Order Number DE92004337. Source: OSTI; NTIS; GPO Dep.

We have continued our work on elucidating the underlying principles that govern chemical reactions occurring on bimetallic and alloy surfaces. Our goal is to aid in the atomic level explanation of the reactivity and selectivity of alloy and bimetallic cluster catalysts and to provide a fundamental basis for the design of new catalysts with improved performance. Our approach is to use a battery of surface science methods to obtain fundamental data on the thermochemistry and kinetics of the adsorption and reaction of molecules on extensively characterized, single-crystal bimetallic surfaces. We measure changes in chemisorption bond strength, adsorption site distributions, and hydrocarbon fragment stability and reactivity and correlate these results with the geometric and electronic structure of the metal atoms on the surface. Often, our aim is to carefully design experiments that isolate the several factors (e.g., ensemble and ligand effects) that control surface chemistry and catalysis on bimetallic and alloy surfaces in order to better understand the importance of each contribution. In the past 18 months, we have continued to study how alkali promoters strongly affect the reactions of hydrocarbons on Pt and Ni surfaces by altering the electronic structure and inducing significant site-blocking effects. We have shown that bismuth coadsorption provides benchmark data on ensemble sizes required for chemical reactions on Pt and Ni surfaces. Surface alloys of Sn/Pt are being used for detailed probing of ensemble sizes and also reactive site requirements. 22 refs.

7079 (ECN-RX-91-005) **The vapour pressure of UCl_4.** Cordfunke, E.H.P. (Netherlands Energy Research Foundation, Petten (Netherlands)); Konings, R.J.M. Netherlands Energy Research Foundation, Petten (Netherlands). Jan 1991. 9p. Order Number DE92613385. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted for publication to the Journal of chemical thermodynamics.

A third-law analysis of the results of measurements of the vapour pressure of UCl_4 shows good agreement between the enthalpies of sublimation from effusion studies, but that other techniques, like transpiration, boiling point or static measurements, give somewhat lower enthalpies of sublimation. In order to resolve this discrepancy the results of a vapour study of uranium tetrachloride by the transpiration technique are reported. (author). 16 refs.; 1 fig.; 2 tabs.

7080 (IC–91/249) **Thermodynamic functions of ethylgermane and ethylsilane from spectroscopic data.** Pandey, A.N. (International Centre for Theoretical Physics, Trieste (Italy)); Bhardwaj, S. International Centre for Theoretical Physics, Trieste (Italy). Aug 1991. 6p. Order Number DE92613323. Source: OSTI; NTIS (US Sales Only); INIS.

The thermodynamic functions - heat capacity, heat content, free energy and entropy have been calculated for two molecules, $CH_3CH_2GeH_3$ and $CH_3CH_2SiH_3$ in the temperature range 5 1/2 - 2000 deg. K at one atmosphere pressure in the ideal gas state by vibrational frequencies and molecular parameters. A rigid rotator harmonic oscillator model is assumed for the two molecules with C_s point group. (author). 4 refs, 3 tabs.

7081 (INIS-mf–13025 vp.) **Recent advances in the thermodynamics of trivalent actinides (Preprint no. IT-08).** David, F. (Institute de Physique Nucleaire, Orsay (France)). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. Feb 1991. 685p. (CONF-9102132–: International symposium on radiochemistry and radiation chemistry - plutonium 50, Bombay (India), 4-7 Feb 1991). In *International symposium on radiochemistry and radiation chemistry (Plutonium - 50 years) (held at Bombay during February 4-7, 1991): Preprints volume.* Order Number DE92001334. Source: OSTI; NTIS (US Sales Only); INIS.

The structure of the trivalent lanthanide and actinide aqua ions has been investigated through radiochemical methods. It is observed that the size of the aqua ions are larger for actinides than for lanthanides with the same crystallographic radii R_c. Hydration numbers N and H corresponding to the primary and second sphere have been deduced. In both series N is varying discontinously with R_c, and the discontinuity corresponds to a greater radius for actinides than for lanthanides. These two differences have been related to shorter cation-water distance and covalency in the actinide series. These informations have been used to improve author's previous hydration model. Gibbs energies are calculated for spheric monovalent, divalent and trivalent ions. Deviations between experimental and calculated data are less than 0.6%. The model allows evaluation of the covalency effect in the actinide series. A model to evaluate entropies of trivalent lanthanide and actinide aquo ions is proposed. (author). 46 refs.

7082 (INIS-mf–13025 vp.) **Some aspects of solution chemistry of plutonium (Preprint no. IT-11).** Patil, S.K. (Bhabha Atomic Research Centre, Bombay (India). Fuel Chemistry Division). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. Feb 1991. 685p. (CONF-9102132–: International symposium on radiochemistry and radiation chemistry - plutonium 50, Bombay (India), 4-7 Feb 1991). In *International symposium on radiochemistry and radiation chemistry (Plutonium - 50 years) (held at Bombay during February 4-7, 1991): Preprints volume.* Order Number DE92001334. Source: OSTI; NTIS (US Sales Only); INIS.

An attempt has been made to review some aspects of solution chemistry of plutonium. (author). 31 refs., 2 tabs.

7083 (INIS-mf–13082) **Chemical, structural and magnetic studies of new mono- and diphosphates appearing in ternary diagrams AO-CuO-(P_2O_5); A= Mg, Ca, Sr, Ba.** Moqine, A. Universite Mohammed 5, Rabat (Morocco). Faculte des Sciences. 1 Dec 1990 164p. (In French). Order Number DE92614763. Source: OSTI; NTIS (US Sales Only); INIS.

A systematic study of mixed mono- and diphosphates of AO-CuO-(P_2O_5) systems (A= Mg, Ca, Sr, Ba) has been carried out. This study showed up, on one hand, continuous and wide ranges in magnesium system and on the other hand, eight new phases in the other systems: Sr sub 18 Cu sub 3 $(PO_4)_{14}$, A_2 Cu $(PO_4)_2$, (A= Sr, Ba), Sr_3 Cu_3 $(PO_4)_4$, $BaCu_2$ $(PO_4)_2$ and $ACu(P_2O_7)$ (A= Ca, Sr, Ba). The crystalline structures of $SrCu(P_2O_7)$, $BaCu(P_2\ O_7)$,Sr_3 Cu_3 $(PO_4)_4$ and $BaCu_2$ $(PO_4)_2$ phosphates have been described and discussed. The first compound presents a Tunnel structure and the three others have Foliation structures. The magnetic behaviours of some Cu sup 2+ ions phos-phates have been correlated to their crystalline structures. The experimental data have been parametered using the Ising model and/or the Heisenberg model. In this work, three Ising theoretical models have been developed. This magnetic study showed up new chains of antiferro- or ferrimagnetic Cu sup 2+ ions. 59 figs., 32 tabs., 113 refs. (author).

7084 (IS-T–1540) **The interaction of formic acid with Pt(111) and the effect of coadsorbed water, atomic oxygen, and carbon monoxide.** Columbia, M.R. Ames Lab., IA (United States). 20 Dec 1991. 247p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. Order Number DE92005094. Source: OSTI; NTIS; INIS; GPO Dep.

We have investigated the reaction of HCOOH with the (111) surface of platinum and its dependence on surface temperature, surface concentration (coverage), and the presence of other adspecies such as H_2O, CO, and atomic oxygen. The motivation for this investigation originates in the electrochemical community, where an interest in the development of fuel cells has existed for years. Small oxygen-containing hydrocarbons like HCOOH show potential as fuels in cells utilizing platinum as the electrode material. The desired reaction in such a cell is the decomposition of the formic acid to produce CO_2, which desorbs from the electrode surface; however, a competing reaction produces adspecies which do not desorb. The accumulation of these adspecies prevents continued adsorption and reaction of formic acid and eventually renders the cell useless. We have probed the reaction of formic acid with Pt(111) in ultrahigh vacuum via thermal desorption spectroscopy and high resolution electron energy loss spectroscopy.

7085 (IS-T–1600) **Reactions of an excited state and of carbon- and sulfur-centere radicals with transition metal complexes.** Huston, P.L. Ames Lab., IA (United States). 3 Dec 1991. 148p. Sponsored by U.S. DOE Energy Research. DOE Contract

W-7405-ENG-82. Order Number DE92005154. Source: OSTI; NTIS; GPO Dep.

The kinetics of the reductive quenching of the ^2E excited state of CrL_3^{3+} (L=2,2′-bipyridine, 1,10-phenanthroline and their substituted analogues) by Ti(3) were investigated at 25°C in 1.0 M LiCl-HCl. The dependence of the rate on hydrogen ion concentration indicates that both $Ti(H_2O)_6^{3+}$ and $(H_2O)_5Ti(OH)^{2+}$ quench. Alkyl radicals, generated from the photohomolysis of organocobalt complexes, were allowed to react in aqueous solution with $(H_2O)_2CrL^{2+}$ (L=1,4,8,11-tetraazacyclopentadecane or $[15]aneN_4$). The reaction rates were evaluated by laser flash photolysis, using the known reaction between R* and the methyl viologen radical cation as a kinetic probe. Reactions of thiyl radicals (RS*) have been studied in aqueous solution using laser flash photolysis. One method used in this study involved generating alkyl radicals by photohomolysis of the cobalt-carbon bond in $RCo([14]aneN_4)^{2+}$ complexes with visible light. The carbon-centered radicals abstract a hydrogen atom from a thiol to form thiyl radicals.

7086 (IS-T–1617) **Nonphotochemical hole burning and relaxation dynamics of amorphous solids at low temperature.** Shu, Luchuan. Ames Lab., IA (United States). 20 Dec 1991. 178p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. Order Number DE92005092. Source: OSTI; NTIS; GPO Dep.

Nonphotochemcial hole burning (NPHB) is applied to cresyl violet perchlorate (CV) in polyvinyl alcohol (PVOH) films. The results of temperature-dependent NPHB, polarization NPHB, spontaneous hole filing (SPHF) and laser induced hole filling (LIHF) are presented. A new mechanism of NPHB is proposed. The relaxation dynamics of amorphous solids at low temperature is extensively studied and a high degree of positive correlation between hole burning and SPHF has been found. Both NPHB and SPHF can be described with dispersive kinetics theory. A more physically reasonable interpretation of SPHF kinetics is described by a new methodology in which absolute hole filling is considered. The data on absolute hole filling together with the observation of a high degree of positive correlation between the rates of burning and filling indicate that the dominant mechanism for filling is not global spectral diffusion but rather anti-hole reversion.

7087 (KAERI-II/RR–14/90) **The development of radioactive waste treatment technology (III): Development of radioactive liquid waste treatment technology (II).** Kim, Joon Hyung (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Jung, Ki Jung; Lee, Kune Woo; Park, Hun Hwee. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Mar 1991. 146p. (In Korean). Order Number DE92614770. Source: OSTI; NTIS (US Sales Only); INIS.

Most PWR stations have experienced leakages of boric acid and oil into liquid radwaste systems. Typically, these wastes have been concentrated by an evaporator system. Based on operating plant experiences, boric acid and oil are the majority of the solid loading for disposal and tend to decrease the efficiency significantly. The objective of these studies is to develop pretreatment techniques for the recovery of boric acid and for the removal of oil from such wastes for improving the evaporator performance. To these objectives, lab. scale reverse osmosis (RO) membrane and filtration/coalescence processes are introduced, which can separate boric acid and oil into waste streams. (Author).

7088 (KAERI/RR–972/90) **A study on the separation characteristics of tritiated water vapor adsorption.** Sung, Ki Woong (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Kim, Yong Eak; Na, Jung Won; Kim, Kwang Rag; Bae, Jae Heum; Chung, Hoong Suck; Ahn, Do Hee; Cho, Young Hyun; Paek, Seong Woo; Kim, In Won. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Feb 1991. 173p. (In Korean). Order Number DE92614764. Source: OSTI; NTIS (US Sales Only); INIS.

In order to reduce the air concentration of ^3H in the reactor building of Wolsung Heavy Water Reactor, a computer code for estimation of adsorption behavior was programmed based on an equation derived for analysis of water vapor adsorption, and a batch and a column apparatus for performance test of adsorption were designed, and a composite adsorption model was introduced for increasement of adsorption efficiency. (Author).

7089 (KFK–4919) **Raman spectroscopic investigation of the formation of $Mg(HCO_3)_2$ used for column regeneration in the MARIX process.** Gantner, E.; Steinert, D. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Radiochemie; Kernforschungszentrum Karlsruhe GmbH (Germany). Projekt Schadstoffbeherrschung in der Umwelt (PSU). Aug 1991. 21p. (In German). Order Number DE92750159. Source: OSTI; NTIS (US Sales Only).

The suitability of a laser Raman spectrometer equipped with optical fibers for remote process control was demonstrated following the reaction of MgO, H_2O and CO_2 under pressure forming $Mg(HCO_3)_2$ which is used as reagent for column regeneration in the MARIX process. The dissolution of MgO at different CO_2 pressures was followed with time measuring the resultant Raman spectra, and in the same manner also the precipitation and redissolution behaviour of nesquehonite (aqueous $MgCO_3$) was studied which is precipitated from solutions containing $Mg(HCO_3)_2$ under normal pressure. In addition, equilibrium concentrations of bicarbonate formed at different CO_2 pressures were determined using the same analytical technique, and the results were compared with computed data. (orig.).

7090 (LBL–31312) **Tritiation methods and tritium NMR spectroscopy.** Jaiswal, D.K. (Defence Research and Development Establishment, Gwalior (India)); Morimoto, H.; Salijoughian, M.; Williams, P.G. Lawrence Berkeley Lab., CA (United States). Sep 1991. 6p. Sponsored by U.S. DOE Energy Research; U.S. Department of Health and Human Services. DOE Contract AC03-76SF00098. Grant P41 RR01237. (CONF-9109287–4: 4. international symposium on the synthesis and applications of isotopes and isotopically labeled compounds, Toronto (Canada), 3 Sep 1991). Order Number DE92004307. Source: OSTI; NTIS; INIS; GPO Dep.

We have used a simple process for the production of highly tritiated water and characterized the product species by ^1H and ^3H NMR spectroscopy. The water is readily manipulated and used in subsequent reactions either as T_2O, CH_3COOT or CF_3COOT. Development of tritiated diimide has progressed to the point where cis-hydrogenated products at 1-20 Ci/mmole S.A. are possible. Tri-n-butyl tin tritide has been produced at >95% tritium content and well characterized by multinuclear NMR techniques. 27 refs., 3 figs.

7091 (LBL–31459) **1. Mono([8]annulene)Uranium(4) half-sandwich complexes, 2. Novel syntheses of symmetrically substituted cyclooctatetetraenes.** Boussie, T.R. Lawrence Livermore National Lab., CA (United States). Oct 1991. 147p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE92003913. Source: OSTI; NTIS; INIS; GPO Dep.

A reproducible, high-yield synthesis of mono([8]annulene)uranium(4)dichloride (1) is reported, along with the X-ray crystal structural of the bis(pyridine) adduct. Metathesis reactions of the half-sandwich complex 1 with a variety of simple alkyl and alkoxy reagents failed to generate any isolable mono-ring complexes. Reactions of 1 with polydentate, delocalized anions did produce stable derivatives, including mono([8]annulene)uranium(4)bis(acetylacetonate) (4). An X-ray crystal structure of 4 is reported.

7092 **Polymerizable 2(2-hydroxynaphthyl) 2H-benzotriazole compounds.** Gomez, P.M.; Neidlinger, H.H. To Dept. of Energy. 1990. Filed date 21 May 1990. USA Patent patent application 7-525,572. 16p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE92004618. Source: OSTI; NTIS; GPO Dep.

It is an object of the invention to provide benzotriazole compounds as a basis for novel polymeric ultraviolet absorbers having higher wavelength cutoffs of up to about 430nm. Particular ultraviolet absorbers are 2(2-Hydroxynaphthyl) 2H-Benzotriazole compounds having polymerizable unsaturated groups attached to the naphthyl double ring. A further object of the invention is to provide 2(2-Hydroxynaphthyl) 2H-Benzotriazole compounds having polymerizable unsaturated groups on the napthyl ring which can be homopolymerized or copolymerized with a comonomer to obtain polymeric ultraviolet absorbers having high wavelength cutoffs of up to about 430nm. 4 figs.

7093 (PSI–109) **The reducibility of sulphuric acid and sulphate in aqueous solution.** Grauer, R. (Paul Scherrer Inst. (PSI), Villigen (Switzerland)). Paul Scherrer Inst. (PSI), Villigen (Switzerland). Jul 1991. 41p. Order Number DE92614765. Source: OSTI; NTIS (US Sales Only); INIS.

In connection with the Swedish project for final storage of spent fuel elements it was necessary to assess whether dissolved sulphate can corrode the copper canister. A simple reaction between copper and sulphate is thermodynamically impossible, but copper can react to give copper sulphide if an additional electron donor such as iron(II) is available. The problem was extended to the more general question of the reducibility of sulphur(VI) in dilute aqueous solution. Chemical reduction of sulphate does not take place in dilute solution at temperatures below 100°C. In experiments on the reduction of sulphates under hydrothermal conditions a reaction only takes place at temperatures above 275-300°C. The oxidising action of sulphuric acid on metals becomes perceptible only at acid concentrations over 45-50%. In experiments on the cathodic reduction of 74% sulphuric acid the formation of hydrogen sulphide and elementary sulphur starts, depending on the current density, at 50-130°C, and polarographic measurements suggest that the reducible species is not the hydrogen sulphate ion but molecular sulphuric acid. The resistance of copper to oxygen-free sulphuric acid up to a concentration of 60% is well-known. Numerous processes in industrial electrochemistry take place in sulphuric acid or sulphate electrolytes. The reversible metal/metal-sulphate electrodes of lead and cadmium are unstable relative to the corresponding metal sulphides. Nevertheless the reversible lead sulphate electrode does not fail from sulphide formation. All these facts confirm that sulphur(VI) in dilute solution is completely inert towards chemical reducing agents and also to cathodic reduction. Thus corrosion of copper by sulphate under final-storage conditions and in the absence of sulphate reducing bacteria can be almost certainly be ruled out. (author) 5 figs., 85 refs.

7094 (SAND–91-2493C) **Radial dependence of silicon KVV and L_{23}VV Auger matrix elements.** Jennison, D.R. (Sandia National Labs., Albuquerque, NM (United States)); Weightman, P. Sandia National Labs., Albuquerque, NM (United States). [1991]. 10p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-911132–10: 38. national symposium of the American Vacuum Society, Seattle, WA (United States), 11-15 Nov 1991). Order Number DE92004216. Source: OSTI; NTIS; GPO Dep.

We present calculations which show the radial dependence of the KVV and L_{23}VV Auger matrix elements of silicon. We find greatly differing dependences, converging within ~1 a.u. of the nucleus in the case of the KVV, but not until ~4 a.u. in the case of the L_{23}VV, well beyond the bond midpoint of ~2.2 a.u. We also find quite different dependences for the various elements within a particular CVV transition. Because the local density of states (LDOS) is dependent on the radius of the sphere of integration, our results suggest that different CVV Auger processes on the same atom in fact probe different LDOS's, as do even different contributions within the same transition. (This effect is separate from the well-known matrix element property which weights angular-momentum components differently.) These results call into question both the single-site LDOS approximation when used in the interpretation of low-energy (< 100 eV) Auger spectra, and the application to high-energy spectra of local densities of states obtained by integration over muffin-tin or Wigner-Seitz spheres which have a large radius compared to the region probed by the Auger process.

7095 (SKB-TR–90-45) **Interim report on the laboratory and theoretical work in modeling the drained and undrained behavior of buffer materials.** Boergesson, L. (Clay Technology AB, Lund (Sweden)). Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Dec 1990. 129p. Order Number DE92613324. Source: OSTI; NTIS (US Sales Only); INIS.

This report describes the continuous work of modeling the geotechnical properties of buffer materials. Some results of laboratory work with drained and undrained tests are described as well as the material models that these test have yielded. The effective stress concept and its relevance is discussed. The technique to apply the models in calculations using the finite element program ABAQUS is described. Some calculations of laboratory verification tests are shown and the results compared. Finally two examples of scenario calculations are shown. The work has led to three material models that can be used in ABAQUS calculations. All parameters for these models are not fully known and a continuation of the work is required. These models are not suitable for all situations and the relevance and need for further developments are presently investigated. (au).

7096 (SKB-TR–91-15) **Uraninite alteration in an oxidizing environment and its relevance to the disposal of spent nuclear fuel.** Finch, R. (Dept. of Geology, Univ. of New Mexico (United States)); Ewing, R. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Dec 1990. 138p. Order Number DE92613325. Source: OSTI; NTIS (US Sales Only); INIS.

Uraninite is a natural analogue for spent nuclear fuel because of similarities in structure and chemistry. Effective assessment of the long-term behavior of spent fuel in a geologic repository requires a knowledge of the corrosion products produced in that environment. Several important natural analogue sites are reviewed, illustrating a wide variety of environments from oxidizing to reducing, including, among others: Cigar Lake, Canada, a uraninite-bearing ore body at depth within a strictly reducing environment; the ore body has 'seen' extensive groundwater interaction with virtually no significant oxidation or mobilization of U apperent. Koongara, Australia is a highly altered uraninite-bearing ore body partially exposed to meteoric water; alteration at depth has resulted from interaction with groundwater having a somewhat reduced Eh compared to the surface. Uraninite, Pb-uranyl oxide hydrates and uranyl silicates control U solubility at depth; uranyl phosphates and U adsorption onto clays and FeMn-oxides control U solubility near the surface. Pocos de Caldas, Brazil displays a redox from moving through uraninite-bearing rocks near the surface and shows local remobilization of U. Oklo, Gabon, a uraninite- and coffinite-bearing ore body, locally affected by intense hydrothermal alteration during fission reactions, demonstrates restricted radionuclide and fission product transport within a reducing environment. A current study being conducted by the authors at Shinkolbwe, Zaire, a uraninite-bearing ore body exposed to highly oxidizing conditions at the surface, provides over 50 species of uranyl phases for detailed study, and illustrates a complex uranyl phase paragenesis over several million years, from earliest-formed uranyl oxide hydrates and uranyl silicates to later-formed uranyl phosphate. (au) (268 refs.).

4004 Electrochemistry

Refer also to citation(s) 6770, 6860, 7073

7097 (DOE/ER/13855–4) **Capacitance of edge plane of pyrolytic graphite in acetonitrile solutions.** Minick, S.K.; Ishida, Takanobu. State Univ. of New York, Stony Brook, NY (United States). Dept. of Chemistry. May 1991. 176p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER13855. Order Number DE92005303. Source: OSTI; NTIS; GPO Dep.

Thesis submitted by S.K. Minick.

The capacitance of the edge plane of pyrolytic graphite electrodes, in acetonitrile solutions, is measured by recording the current response to an applied triangular voltage sweep; TVS, and then fitting the current response with an appropriate function, (via a set of adjustable parameters). The pretreatment of the electrodes, the supporting electrolyte concentration used, and the frequency of the input TVS, were all found to affect the measured capacitance. In these experiments, a background current was also seen and the shape of the current output for the TVS; the charging/discharging curve, is shown to correlate with the magnitude of this background current. In addition, the size of the background current was found to have some dependence on the type of electrode pretreatment procedure used. 60 refs., 49 figs., 3 tabs.

7098 (KCP–613-4506) **Development of high performance liquid chromatographic methods for copper cyanide plating bath additives: Final report.** Foster, R.L. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. Dec 1991.

60p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00613. Order Number DE92004879. Source: OSTI; NTIS; GPO Dep.

The analysis of two plating bath additives used in a copper cyanide plating process are described. Methods were developed that produced HPLC separation of the components and identification of the separated components obtained through mass spectral and nuclear magnetic resonance analyses. The methods can be used for acceptance testing of the additives, and quantitation of components can be performed if suitable standards are obtained. Napthalene sulfonic acid detergents, diphenylsulfones, and five different unidentified compounds behaving like salts were found in additive A. Additive B was found to contain the compound 2-pentene-3-ol, and two or three more components may be present. Acidification with phosphoric acid to a pH of about 2.5 produced a distinctly different chromatogram, indicating the components are affected by pH.

4005 Photochemistry

Refer also to citation(s) 6974, 7065, 7070, 7085, 7086

7099 (DOE/ER/13592–6) **Photoexcited charge pair escape and recombination: Progress report, November 15, 1990–November 14, 1991.** Braun, C.L. Dartmouth Coll., Hanover, NH (United States). Dept. of Chemistry. 15 Nov 1991. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER13592. Order Number DE92004030. Source: OSTI; NTIS; GPO Dep.

We report photocurrent transients arising from the pulsed laser excitation of the dipolar first excited singlet sate S_1 of trans 4-dimethyl-amino-4′-nitrostilbene (DMANS) in toluene solution. The currents arise from rotational reorientation of DMANS dipoles with respect to the axis of an applied electric field. The method appears to offer a simple and general approach to the measurement of the change in dipole moment upon electronic excitation of a molecule. In another experiment, durene (1,2,4,5-tetramethylbenzene) dissolved in n-hexane was photoionized by 35 psec pulses at 266 nm. Transient absorption at 1064 nm arising chiefly from geminate electrons was detected and used to monitor the recombination of the electron-cation pairs produced by two-photon ionization. An excellent fit to the recombination kinetics was obtained by assuming that the distribution of initial electron-cation separations was of the form $r^2EXP = r^2/(2L^3)exp(-r/L)$ with a mean radius 3L = 5.7 nm.

7100 (DOE/ER/13860–4) **[Time-resolved FTIR emission studies of laser photofragmentation and radical reactions]: Progress report, 1 April 1991–15 November 1991.** Colorado Univ., Boulder, CO (United States). [1991]. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER13860. Order Number DE92004080. Source: OSTI; NTIS; INIS; GPO Dep.

Short communication. RADICALS/chemical reaction kinetics; AMMONIA/photochemical reactions; PROGRESS REPORT; FOURIER TRANSFORMATION; RADICALS; AMMONIA; ENERGY TRANSFER; DISSOCIATION; INFRARED RADIATION; FRAGMENTATION

7101 (LBL–31466) **Photoelectron and photodissociation studies of free atoms and molecules, using synchrotron radiation.** Medhurst, L.J. Lawrence Berkeley Lab., CA (United States). Nov 1991. 138p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE92004001. Source: OSTI; NTIS; INIS; GPO Dep.

High resolution synchrotron radiation and Zero-Kinetic-Energy Photoelectron spectroscopy were used to study two-electron transitions in atomic systems at their ionization thresholds. Using this same technique the core-ionized mainline and satellite states of N_2 and CO were studied with vibrational resolution. Vibrationally resolved synchrotron radiation was used to study the dissociation of N_2, C_2H_4, and CH_3Cl near the N 1s and C 1s thresholds. The photoelectron satellites of the argon 3s, krypton 4s and xenon 4d subshells were studied with zero kinetic energy photoelectron spectroscopy at their ionization thresholds. In all of these cases, satellites with lower binding energies are enhanced at their thresholds while those closer to the double ionization threshold are suppressed relative to their intensities at high incident light energies.

4006 Radiation Chemistry

Refer also to citation(s) 6358, 6489, 7011, 7134

7102 (DOE/ER/60455–5) **Mechanisms for radiation damage in DNA: Progress report, June 1, 1991–May 31, 1992.** Sevilla, M.D. Oakland Univ., Rochester, MI (United States). Dec 1991. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER60455. Order Number DE91019079. Source: OSTI; NTIS; INIS; GPO Dep.

In this project we have proposed several mechanisms for radiation damage and recently radiation protection to DNA and its constituents, and have detailed a series of experiments utilizing electron spin resonance spectroscopy, HPLC and GC-mass spectroscopy to test the proposed mechanisms. In this years' work we have continued the investigation of the localization of the initial charges on DNA after irradiation through experiment and through the use of ab initio molecular orbital theory. The experimental results and MO calculations are in agreement that cytosine, not thymine, is likely the principal locus for excess charge; whereas guanine is confirmed as the initial site for the cationic charge. The mechanism for the anion localization on cytosine is clarified by MO calculations of DNA base pair and stacked base pair (GC/AT) ion radicals. In addition predictions made from a new model of ion transfer in DNA are tested and confirmed by an ESR investigation of irradiated single stranded DNA. In this years' effort in joint work with Wake Forest University we have also made excellent progress in the study of products produced from the direct effect of radiation on DNA. The release of unaltered bases and DNA base damage products are shown to be a function of hydration layer and evidence for a demarcation between the direct and indirect effect of radiation is presented. DNA base products from irradiations at ambient temperatures are shown to be those that would be predicted from ESR studies at low temperatures. In addition initial studies of radiation effects on DNA-protein complexes and certain sensitive amino acids have been initiated to shed light on the role of histones on DNA radiation damage. 16 refs., 2 figs., 1 tab.

7103 (DOE/ER/60455–6) **Mechanisms for radiation damage in DNA: Comprehensive report, June 1, 1986–May 31, 1992.** Sevilla, M.D. Oakland Univ., Rochester, MI (United States). Dec 1991. 27p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER60455. Order Number DE91019080. Source: OSTI; NTIS; INIS; GPO Dep.

Recent work in our laboratory has been instrumental in the reformulation of the current model for radiation damage in DNA. We have found that radical ion distribution is a function of strandedness of the DNA. A new model for ion transport through DNA is proposed. We completed an extensive ab initio molecular orbital study of the ion radicals species envolved in DNA radiation damage. In this effort the ionization energies (IE), electron affinities (EA), relative energies, fully optimized structural parameters and spin densities were determined. Joint work with Steven Swarts and Ken Wheeler of Wake Forest on yields of products on irradiation of DNA has also yielded new insights to radiation damage to DNA - specifically the division between the direct and indirect effect. Perhaps our most important work during this period has been in the area of the interaction of thiyl radicals and oxygen as well as (DNA) peroxyl radicals with thiols. The sulfinyl radical, RSO·, was not previously known to be a product of thiol-or carbon-based peroxyl reaction with RSH. The structure of the thiyl peroxyl radical, RSOO, was uncertain. The conversion of RSOO to the sulfonyl radical, RSO_2, and the subsequent reaction with oxygen to form the sulfonyl peroxyl radical, RSO_2OO, had never been suggested in the literature. We have investigated the reactions of thiols with primary ion radicals in γ-irradiated DNA and observed electron transfer from the thiol to the guanine cation radical. This is believed to be the major protective effect of thiols from the direct effect of radiation. Our work with peroxyl radicals has also established that the ESR measured O-17 hyperfine couplings give a good estimate of the relative reactivity of the peroxyl group and shows that the thiol peroxyl radical cannot be a effective hydrogen abstracting agent. 52 refs., 1 tab.

7104 (EGG-WTD-9935) **High energy decomposition of halogenated hydrocarbons: Final report, FY 91.** Mincher, B.J.; Meikrantz, D.H.; Arbon, R.E.; Murphy, R.J. EG and G Idaho, Inc., Idaho Falls, ID (United States). Oct 1991. 15p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC07-76ID01570. Order Number DE92003302. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this effort is to demonstrate a viable process for breaking down hazardous halogenated organic wastes to simpler, non-hazardous wastes using high energy ionizing radiation. The INEL effort focuses on the use of spent reactor fuel gamma radiation sources to decompose complex wastes such as PCBs. The INEL irradiation experiments concentrated on a single PCB congener so that a limited set of decomposition reactions could be studied. The congener 1, 2′, 3, 3′, 4, 5′, 6, 6′ - octachlorobiphenyl was examined followed exposure to various gamma doses at the ATR spent fuel pool. The decomposition rates and products in several solvents are discussed. 7 refs., 5 figs., 3 tabs.

7105 (INIS-mf-13025 vp.) **Current status of radiation chemistry and radiation processing in the USSR (Preprint no. IT-27).** Pikaev, A.K. (AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. Feb 1991. 685p. (CONF-9102132-: International symposium on radiochemistry and radiation chemistry - plutonium 50, Bombay (India), 4-7 Feb 1991). In *International symposium on radiochemistry and radiation chemistry (Plutonium - 50 years) (held at Bombay during February 4-7, 1991): Preprints volume.* Order Number DE92001334. Source: OSTI; NTIS (US Sales Only); INIS.

The paper is a brief review of current status of radiation chemistry and radiation processing in the U.S.S.R. The most important recent achievements in these fields are discussed. The trends of further development are considered. (author). 30 refs., 3 tabs.

7106 (INIS-mf-13025 vp.) **Solvation of excess electron in polar liquid: an overview (Preprint no. RC-01).** Bandyopadhyay, T. (Bhabha Atomic Research Centre, Bombay (India). Chemistry Div.). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. Feb 1991. 685p. (CONF-9102132-: International symposium on radiochemistry and radiation chemistry - plutonium 50, Bombay (India), 4-7 Feb 1991). In *International symposium on radiochemistry and radiation chemistry (Plutonium - 50 years) (held at Bombay during February 4-7, 1991): Preprints volume.* Order Number DE92001334. Source: OSTI; NTIS (US Sales Only); INIS.

Most recent advances in time-resolved studies of solvation of excess electron and its geminate recombination in polar liquid in the picosecond to subpicosecond time domain has been reviewed. Emphasis is given on the applicability of two-state model of solvation of this species. Potentiality of Feynman path integral technique and SCF-X$^{\alpha}$-SW technique to describe absorption spectrum of this species has been indicated. (author).

7107 (INIS-SU-290, pp. 95-96) **Radiation-chemical transformations in benzene solutions of cobalt(2) acetylacetonate.** Zatonskij, S.V. (Moskovskij Gosudarstvennyj Univ., Moscow (USSR)); Makhlyarchuk, V.V.; Saraeva, V.V. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433-: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. 1 ref. ACETYLACETONE/chemical radiation effects; BENZENE/chemical radiation effects; COBALT COMPLEXES/chemical radiation effects; ACETYLACETONE; BENZENE; DOSE RATES; G VALUE; GAMMA RADIATION; OXIDATION; RADIATION DOSES; SOLUTIONS

7108 (INIS-SU-290, pp. 97-98) **Hemial recombination of electron-ion pairs in irradiated tri-n-butyl phosphate and its mixtures with hexane: an empirical approach.** Zajtsev, V.D. (AN SSSR, Moscow (USSR). Inst. Ehlektrokhimii); Protasova, E.L.; Tsarevskij, A.V.; Khajkin, G.I. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433-: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. 1 ref. HEXANE/radiolysis; ION PAIRS/recombination; TBP/radiolysis; G VALUE; HEXANE; RADIOLYSIS; RECOMBINATION; IONIZING RADIATIONS; LOW TEMPERATURE; SOLUTIONS; SOLVATED ELECTRONS; TBP

7109 (INIS-SU-290, pp. 98-99) **Radiation-chemical behaviour and spectroscopic characteristics of solvated electrons in some trialkyl phosphates.** Zajtsev, V.D. (AN SSSR, Moscow (USSR). Inst. Ehlektrokhimii); Suprunenko, M.O.; Khajkin, G.I. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433-: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. 1 ref. CYCLOALKANES/radiolysis; HEXANE/radiolysis; PHOSPHORIC ACID ESTERS/radiolysis; SOLVATED ELECTRONS/chemical reaction kinetics; ABSORPTION SPECTRA; CYCLOALKANES; RADIOLYSIS; ELECTRON BEAMS; HEXANE; MEV RANGE 01-10; PULSED IRRADIATION; RADIATION DOSES; SOLUTIONS

7110 (INIS-SU-290, pp. 53) **Radiation-heterogeneous processes in contact of metallic materials (zirconium alloys and aluminium) of nuclear reactors with water.** Garibov, A.A. (AN Azerbajdzhanskoj SSR, Baku (USSR). Sektor Radiatsionnykh Issledovanij); Velibekova, G.Z.; Dzhafarov, Ya.D.; Agaev, T.N. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433-: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. ALUMINIUM/chemical radiation effects; NIOBIUM ALLOYS/chemical radiation effects; WATER/chemical radiation effects; ZIRCONIUM BASE ALLOYS/chemical radiation effects; ALUMINIUM; CORROSION; DOSE RATES; G VALUE; HIGH TEMPERATURE; HYDROGEN; IONIZING RADIATIONS; MEDIUM TEMPERATURE; OXIDATION; VERY HIGH TEMPERATURE; WATER

7111 (INIS-SU-290, pp. 54) **Effect of gamma-irradiation and temperature on isomer composition of triisoamyl phosphate and its destruction products.** Glebov, V.A. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Neorganicheskikh Materialov, Moscow (USSR)); Kulikov, I.A.; Kuprij, A.A.; Pershin, A.D.; Vladimirova, M.V. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. PHOSPHORIC ACID ESTERS/radiolysis; GAMMA RADIATION; HIGH TEMPERATURE; ISOMERIZATION; NMR SPECTRA; RADIOLYSIS; PYROLYSIS PRODUCTS

7112 (INIS-SU–290, pp. 55) **Features of radiolysis of diluted solutions of cesium iodide.** Gorbovitskaya, T.I. (Latvijskij Gosudarstvennyj Univ., Riga (USSR)); Kants, L.K.; Tiliks, Yu.E.; Ozola, I.A.; Luzanova, L.M.; Kotelkin, I.M. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. AQUEOUS SOLUTIONS/radiolysis; CESIUM IODIDES/radiolysis; RADIOLYSIS; BORIC ACID; COMPUTERIZED SIMULATION; IONIZING RADIATIONS; RADIATION DOSES; REACTOR CORE DISRUPTION

7113 (INIS-SU–290, pp. 56) **Intracomplex radiolytic oxidations of Cu^+ and Fe^{2+} in complexes $[Cu(CN)_4]^{3-}$, $[Fe(CN)_6]^{4-}$ in the presence of ozone.** Gambaryan, I.A. (AN Armyanskoj SSR, Ashtarak (USSR). Inst. Fizicheskikh Issledovanij). AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. 1 ref. COPPER COMPLEXES/chemical radiation effects; FERROCYANIDES/chemical radiation effects; CHEMICAL REACTION KINETICS; CYANIDES; FERROCYANIDES; IONIZING RADIATIONS; OXIDATION; OZONE

7114 (INIS-SU–290, pp. 58) **Radiation modifying of mixtures based on polymers and copolymers of ethylene.** Gordijchuk, T.N. (AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Fizicheskoj Khimii); Gordienko, V.P. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. POLYETHYLENES/chemical radiation effects; POLYVINYLS/chemical radiation effects; COBALT 60; COPOLYMERS; ELECTRONS; ETHYLENE; FILLERS; GAMMA RADIATION; MECHANICAL PROPERTIES; MIXTURES; POLYETHYLENES; POLYVINYLS; RADIATION DOSES

7115 (INIS-SU–290, pp. 60) **Mutarotation of glucose in dimethyl sulfoxide solution under γ-radiation.** Glushonok, G.K. (Belorusskij Gosudarstvennyj Univ., Minsk (Byelorussian SSR)); Maslovskaya, L.A.; Petryaev, E.P. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. DMSO/chemical radiation effects; GLUCOSE/chemical radiation effects; CHEMICAL REACTION KINETICS; DMSO; GAMMA RADIATION; GLUCOSE; ISOMERIZATION; OPTICAL ACTIVITY; RADIATION DOSES; SOLUTIONS

7116 (INIS-SU–290, pp. 62) **Radiolysis of rhodanide-ions in oxidative media.** Gambaryan, I.A. (AN Armyanskoj SSR, Ashtarak (USSR). Inst. Fizicheskikh Issledovanij). AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. 1 ref. THIOCYANATES/radiolysis; AQUEOUS SOLUTIONS; CHEMICAL REACTION KINETICS; G VALUE; OZONE; PH VALUE; THIOCYANATES; RADIOLYSIS

7117 (INIS-SU–290, pp. 62-63) **Investigation into reactivity of hydrated electrons and H atoms in respect to actinoid ions in acidic aqueous solutions using pulsed radiolysis method.** Gogolev, A.V.; Shilov, V.P.; Fedoseev, A.M.; Pikaev, A.K. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. ACTINIDE COMPOUNDS/chemical reaction kinetics; AQUEOUS SOLUTIONS/radiolysis; HYDROGEN/chemical reaction kinetics; SOLVATED ELECTRONS/chemical reaction kinetics; RADIOLYSIS; ATOMS; HYDRATION; HYDROGEN; OXIDATION; PERCHLORIC ACID; PULSED IRRADIATION; REDOX POTENTIAL; REDUCTION; SULFURIC ACID

7118 (INIS-SU–290, pp. 63-64) **Effect of OH^- and Cl^- concentrations on yields of Cl_2^-formation in concentrated aqueous solutions of chlorides.** Grigor'ev, A.E.; Makarov, I.E.; Pikaev, A.K. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. AQUEOUS SOLUTIONS/radiolysis; LITHIUM CHLORIDES/radiolysis; MAGNESIUM CHLORIDES/radiolysis; ANIONS; RADIOLYSIS; G VALUE; HYDROXIDES; IONIZING RADIATIONS; PULSED IRRADIATION; QUANTITY RATIO; RADICALS

7119 (INIS-SU–290, pp. 66) **Calculation of yields of water radiolysis products for nuclear reactor cores.** Gordeev, A.V.; Ershov, B.G. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. WATER/radiolysis; ALPHA PARTICLES; BORIC ACID; COOLANTS; DOSE RATES; FAST NEUTRONS; G VALUE; GAMMA RADIATION; QUANTITY RATIO; REACTOR CORES; WATER; RADIOLYSIS; WWER-3 REACTOR

7120 (INIS-SU–290, pp. 67) **Radiation-induced processes in α-LiIO$_3$.** Golovej, A.D. (Kemerovskij Gosudarstvennyj Univ., Kemerovo (USSR)); Semenov, S.V.; Safonov, Yu.N. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. IODATES/radiolysis; LITHIUM COMPOUNDS/radiolysis; CRYSTAL DEFECTS; CRYSTALS; IODATES; RADIOLYSIS; IONIZING RADIATIONS

7121 (INIS-SU–290, pp. 68) **Radiation-chemical processes in nickel-containing solutions of electroplating production.** Gabisoniya, L.V. (AN Gruzinskoj SSR, Tbilisi (USSR). Inst. Neorganicheskoj Khimii i Ehlektrokhimii); Tushurashvili, R.G. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. NICKEL COMPOUNDS/chemical radiation effects; WASTE WATER/chemical radiation effects; AQUEOUS SOLUTIONS; CHEMICAL REACTION KINETICS; ELECTROPLATING; G VALUE; GAMMA RADIATION; HYDROCHLORIC ACID; REDUCTION; SULFURIC ACID; WASTE PROCESSING

7122 (INIS-SU–290, pp. 69) **Effect of chain length of n-paraffin diluents on agregate stability of dispersed extraction systems.** Gumenyuk, V.E. (AN SSSR, Moscow (USSR). Inst. Ehlektrokhimii); Pribush, A.G.; Egorov, G.F. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. ALKANES/radiolysis; TBP/radiolysis; AGGLOMERATION; ALKANES; RADIOLYSIS; IONIZING RADIATIONS; MOLECULAR WEIGHT; ORGANIC SOLVENTS; RADIATION DOSES; SOLVENT EXTRACTION; STABILITY; TBP

7123 (INIS-SU–290, pp. 72-73) **Kinetic features of radiation polymerization of fluorated esters of meth- and acrylic acids.** Duflot, V.R.; Tokareva, N.N. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. ACRYLIC ACID ESTERS/chemical radiation effects; METHACRYLIC ACID ESTERS/chemical radiation effects; CHEMICAL REACTION KINETICS; IONIZING RADIATIONS; ORGANIC FLUORINE COMPOUNDS; POLYMERIZATION

7124 (INIS-SU–290, pp. 74-75) **Kinetic analysis of radiation- and thermostimulated reactions of iron formates.** Doroshenko, V.N. (AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Fiziko-Tekhnicheskij Inst.); Entinzon, I.R.; Doroshenko, Ver.N.; Denisenko, V.A. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. FORMATES/chemical radiation effects; IRON COMPOUNDS/chemical radiation effects; CHEMICAL REACTION KINETICS; ELECTRONS; FORMATES; HYDRATES; MEV RANGE 01-10; PYROLYSIS; VALENCE

7125 (INIS-SU–290, pp. 81-82) **Pulse radiolysis of sodium nitrate crystals alloyed by nitrite ions.** Dolganov, V.S. (Kemerovskij Gosudarstvennyj Univ., Kemerovo (USSR)). AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. 3 refs. SODIUM NITRATES/radiolysis; ACTIVATION ENERGY; CHEMICAL REACTION KINETICS; COLOR CENTERS; CRYSTALS; DOPED MATERIALS; G VALUE; GAMMA RADIATION; NITRITES; PULSED IRRADIATION; RADICALS; RADIOLYSIS

7126 (INIS-SU–290, pp. 83-84) **Radiation-catalytic oxidation of ammonium bisulfite.** Danilenko, A.V. (Kazakhskij Gosudarstvennyj Univ., Alma-Ata (USSR)); Muratbekov, M.B.; Bugaenko, L.T. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. AMMONIUM COMPOUNDS/chemical radiation effects; SULFITES/chemical radiation effects; ADDITIVES;

AQUEOUS SOLUTIONS; CATALYSIS; CHEMICAL REACTION KINETICS; DOSE RATES; G VALUE; IONIZING RADIATIONS; OXIDATION; QUANTITY RATIO; SULFITES

7127 (INIS-SU–290, pp. 105-106) **Radiation-induced vapour-phase encapsulation and modification of highly dispersed solids.** Kirpikov, S.V.; Bruk, M.A. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. POWDERS/chemical radiation effects; POWDERS/encapsulation; PARTICLE SIZE; POLYMERIZATION; POWDERS; ENCAPSULATION; VINYL MONOMERS

7128 (INIS-SU–290, pp. 110) **Radiation-chemical synthesis of homogeneous ion-exchange membranes with improved properties.** Kocherginskaya, L.L.; Cherskidova, E.E.; Smirnova, I.V.; Terekhov, V.D. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. MEMBRANES/chemical preparation; MEMBRANES/chemical radiation effects; FILMS; ION EXCHANGE MATERIALS; MEMBRANES; POLYMERIZATION; POLYOLEFINS; SPECIFICATIONS; VINYL MONOMERS

7129 (KAERI/RR–965/90) **Studies on heat shrinkage PVC tubes.** Pyun, Hyung Chick (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Kim, Ki Yup; Nho, Young Chang. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1991. 56p. (In Korean). Order Number DE92614805. Source: OSTI; NTIS (US Sales Only); INIS.

Radiation crosslinking of PVC was investigated for the purpose of obtaining a suitable formulation for heat shrinkable tube. PVC was not only compounded with various crosslinking agents and plasticizers to evaluate their effects on the radiation sensitivity, heat shrinkable property and other mechanical properties, but also mixed with NBR, crosslinking agents and plasticizers to obtain efficient crosslinking yield and suitable mechanical properties for heat shrinkable tube. Gel yield of PVC increased with increasing unsaturation levels per molecular weight of crosslinking agents. Among crosslinking agents tested, TMPTMA with three unsaturated groups showed highest gel yield, while PVC containing NBR was more sensitive to crosslinking than PVC itself regardless the types of crosslinking agents and plasticizers. Tensile strength was increased with increasing radiation dose and gel percent, but elongation decreased. It was found that gel percent was increased with increasing radiation dose, heat transformation was decreased with increasing gel percent. When NBR was mixed with PVC, the radiation dosage required for enhancing yield of gel percent and heat transformation were found to be much smaller comparing with the case containing no NBR. Therefore, the addition of NBR to PVC was very effective to increase heat-resisting property of PVC. Heat shrinkage was not much varied with radiation dose, the types of crosslinking agents and plasticizers, but it was increased remarkably with decreasing stretching temperature and increasing annealing temperature. (Author).

7130 (KFK–4850, pp. 140-144) **Investigations into the occurrence of penetrating iodine species. Pt. 2.** Leskopf, W. (Kernforschungszentrum Karlsruhe GmbH (Germany). Lab. fuer Aerosolphysik und Filtertechnik 2); Holl, S. Kernforschungszentrum Karlsruhe GmbH (Germany). Projekt Nukleare Sicherheitsforschung. Jul 1991. (In German). In *Safety oriented LWR research. Annual report 1990.* 270p. Order Number DE92758922. Source: OSTI; NTIS (US Sales Only); INIS.

Investigations on the formation of penetrating iodine species have been continued. Alcohol (methanol, ethanol) and alkene (ethylene, propylene) vapour-air mixtures were radiolyzed with iodine in a Co-60 gamma source. The concentration and the irradiation doses were varied (4,45 E + 04-6,2 E + 06 rad). The gaseous products were analyzed qualitatively and quantitatively by an ECD and a MSD detector for iodine compounds difficult to separate. (orig.).

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Refer also to citation(s) 6365, 6416, 6647, 6976, 6990, 7064, 7079, 7081, 7082, 7091, 7117, 7648, 7679

7131 (CNIC–00410) **A new technique for ion beam tritium labelling.** Zhang Nianbao (Academia Sinica, Shanghai, SH (China). Shanghai Inst. of Nuclear Research); Sheng Shugang; Yao Fuzeng. China Nuclear Information Centre, Beijing, BJ (China). Jun 1990. 9p. (In Chinese). (SINR–0001.). Order Number DE92613351. Source: OSTI; NTIS (US Sales Only); INIS.

An advanced technique, the ion beam tritium labelling method (IBTL), used for labelling proteins, peptides and other nonvolatile organic compounds is introduced. In this method the excited tritium ion beam is accelerated and then bombs a solid sample target in which tritium exchanging for hydrogen is taken place. The IBTL has been used for preparation of tritiated soybean trypsin inhibitor, ribonuclease A, elastin and pachyman etc. After purifing by dialysis, ion exchange chromatography and gel filtration, the tritiated proteins and polysaccharide were obtained with the specific activity over 37 GBq/mmol, the function of tritiated decomposition products was not found. The product was shown to have native biological activity. Amino acid analysis of tritiated protein showed that the relative specific radioactivities were higher for His., Tyr. and Phe. but lower for Val., Ile. and Ser.

7132 (CNIC–00432) **Successive change regularity of actinide properties with atomic number: On the 30th anniversary of the completion of actinides.** Yang Xuexian (Chinese Academy of Agricultural Sciences, Beijing, BJ (China). Inst. for Application of Atomic Energy). China Nuclear Information Centre, Beijing, BJ (China). Aug 1990. 17p. (In Chinese). (CSNAS–0034.). Order Number DE92613346. Source: OSTI; NTIS (US Sales Only); INIS.

The development and achievements on chemistry of actinide elements are summarised. The relations of properties of actinides to their electronic configurations of valence electronic shells are discussed. Some anomalies of solid properties, the radius contraction, the stable state effect of f^{7n}-orbits (n = 0, 1, 2) and the tetrad effect of oxidation states, etc., with atomic number (Z) are described. 31 figures appended show directly the successive change regularity of actinide properties with Z.

7133 (DOE/ER/40402–4) **[Studies of target fragmentation in intermediate energy, relativistic and ultra-relativistic nuclear collisions]: Nuclear chemistry progress report, August 1, 1990–August 1, 1991.** Loveland, W.D. Oregon State Univ., Corvallis, OR (United States). Aug 1991. 34p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-88ER40402. Order Number DE92004393. Source: OSTI; NTIS; INIS; GPO Dep.

The work described herein is part of a project involving the study of low energy (< 10 MeV/A), intermediate energy (10–100 MeV/A) and relativistic (> 250 MeV/A) heavy ion reactions. In the low energy regime, we published a monograph on the properties of the heaviest elements and used that publication as a basis for making a set of "best" semi-empirical predictions of heavy element decay properties. The intermediate energy research effort focussed upon the completion of studies already begun and the initiation of a number of new experiments. In our study of a interaction of 21 MeV/nucleon ^{129}Xe with ^{197}Au, we compared the characteristics of the observed deep inelastic phenomena with various models of dissipative reactions and found significant discrepancies between observations and predictions. These discrepancies seemed to be caused by an improper treatment of pre-equilibrium in the early stages of the collision. In our study of the relativistic interaction of 400 MeV/nucleon ^{12}C with ^{197}Au, we reported the first direct physical measurement of the properties of the spallation residues from a nucleus-nucleus collision. We found the residue energies to be much lower than those predicted by the intranuclear cascade model, indicating some substantial modifications of that model are needed. But, we also found, indications of significant, non-zero values of the residue transverse momentum, a finding that calls into question the interpretation of a number of radiochemical recoil studies of the kinematics of high energy reactions. A program of performing numerical simulations of intermediate and high energy nuclear collisions using the QMD model was initiated.

7134 (INIS-mf–13025) **International symposium on radiochemistry and radiation chemistry (Plutonium - 50 years) (held at Bombay during February 4-7, 1991): Preprints volume.** Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. 1991 685p. (CONF-9102132–: International symposium on radiochemistry and radiation chemistry - plutonium 50, Bombay (India), 4-7 Feb 1991). Order Number DE92001334. Source: OSTI; NTIS (US Sales Only); INIS.

Individual papers are processed separately for the data base. (DLC)

7135 (INIS-mf–13025 vp.) **Studies on plutonium and neptunium chemistry at Cadarache (Preprint no. IT-06).** Beauty, M. (Centre d'Etudes Nucleaires de Cadarache, St Paul lez Durance (France)); Larroque, J. Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. Feb 1991. 685p. (CONF-9102132–: International symposium on radiochemistry and radiation chemistry - plutonium 50, Bombay (India), 4-7 Feb 1991). In *International symposium on radiochemistry and radiation chemistry (Plutonium - 50 years) (held at Bombay during February 4-7, 1991): Preprints volume.* Order Number DE92001334. Source: OSTI; NTIS (US Sales Only); INIS.

After an historical review on the chemistry of the transuranium elements developed in author's laboratory since 1949, fundamental research on the 5f elements during the last five years is presented briefly. More broad aspect has been discussed for the actinide borides, with focus on the chemical bonding and correlation with atom radii. (author). 13 refs., 4 tabs., 5 figs.

7136 (INIS-mf–13025 vp.) **Stability of pentavalent plutonium (Preprint no. IT-12).** Capdevila, H. (CEA DSD/SCS/SGC, Fontenay aux Roses (France)); Vitorge, P. Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. Feb 1991. 685p. (CONF-9102132–: International symposium on radiochemistry and radiation chemistry - plutonium 50, Bombay (India), 4-7 Feb 1991). In *International symposium on radiochemistry and radiation chemistry (Plutonium - 50 years) (held at Bombay during February 4-7, 1991): Preprints volume.* Order Number DE92001334. Source: OSTI; NTIS (US Sales Only); INIS.

Pu(V) stability in Na, H (0.1 or 1 M) ClO_4 (0.1 to 3 M), and in environmental conditions is discussed. It is shown that PuO_2^+ can be stable from pH=1 to 8. Redox potentials and activity coefficients are reviewed, and it is concluded that there was too few experimental determinations of E($PuO_2^+Pu^{4+}$). The disproportionation constants of PuO_2^+ and Pu^{4+} are then measured spectrophotometrically and extrapolated to 0 ionic strength. (author). 11 refs., 3 figs.

7137 (INIS-mf–13025 vp.) **Fission produced ^{99}Mo (Preprint no. IT-30).** Desai, C.N. (Board of Radiation and Isotope Technology, Bombay (India)). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. Feb 1991. 685p. (CONF-9102132–: International symposium on radiochemistry and radiation chemistry - plutonium 50, Bombay (India), 4-7 Feb 1991). In *International symposium on radiochemistry and radiation chemistry (Plutonium - 50 years) (held at Bombay during February 4-7, 1991): Preprints volume.* Order Number DE92001334. Source: OSTI; NTIS (US Sales Only); INIS.

The object of this article is to review the current status and recent history of the technology (mostly chemical and chemical engineering) involved in recovering fission produced ^{99}Mo from a mixture of fission products and in purifying ^{99}Mo to the exceedingly high degree required for medical applications. (author). 7 refs.

7138 (INIS-mf–13025 vp.) **Preparation of a multitracer solution from gold foil bombarded by 95 MeV/nucleon ^{40}Ar ions in ring cyclotron (Preprint no. NC-05).** Ambe, F. (Institute of Physical and Chemical Research, Wako, Saitamo (Japan)); Ambe, S.; Iwamoto, M.; Ohkubo, Y.; Chen, S.Y.; Garg, A.N. Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. Feb 1991. 685p. (CONF-9102132–: International symposium on radiochemistry and radiation chemistry - plutonium 50, Bombay (India), 4-7 Feb 1991). In *International symposium on radiochemistry and radiation chemistry (Plutonium - 50 years) (held at Bombay during February 4-7, 1991): Preprints volume.* Order Number DE92001334. Source: OSTI; NTIS (US Sales Only); INIS.

Simultaneous use of a number of radioactive tracers is useful for the precise determination of characteristic behaviour of different element under identical experimental conditions. 20 and 100 μM thick gold foils were irradiated with 95 MeV/nucleon ^{40}Ar beam in Ring cyclotron employing falling ball irradiation system. A number of radionuclides are formed primarily by spallation reaction of energetic heavy ion beam. A radiochemical method has been developed for the separation of radionuclides. (author). 2 refs., 1 fig.

7139 (INIS-mf–13025 vp.) **Initial retention, isochronal annealing and thermal analysis: a correlation (Preprint no. NC-04).** Dedgaonkar, V.G. (Poona UNiv., Pune (India). Dept. of Chemistry); Apte, R.G.; Bhagwat, D.A. Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. Feb 1991. 685p. (CONF-9102132–: International symposium on radiochemistry and radiation chemistry - plutonium 50, Bombay (India), 4-7 Feb 1991). In *International symposium on radiochemistry and radiation chemistry (Plutonium - 50 years) (held at Bombay during February 4-7, 1991): Preprints volume.* Order Number DE92001334. Source: OSTI; NTIS (US Sales Only); INIS.

Cation effect on initial retention and recovery after heating in ten different lanthanide bromates is investigated. Difference in weight loss after decomposition seems to be more significant. (author). 3 refs., 1 tab.

7140 (IPEN-PUB–338) **Production of lyophilized macroaggregated albumin (MAA) kits to be labelled with sup(99m)Tc for lung scanning.** Hamada, E.S.; Muramoto, E.; Brito, R.H.; Sosa de Pereira, N.P.; Almeida, M.A.T. de. Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, SP (Brazil). Jun 1991. 14p. (In Portuguese). Order Number DE92613352. Source: OSTI; NTIS (US Sales Only); INIS.

Among the various macroaggregation procedures described in the literature, we have developed a rapid and reliable method for the routine production of lyophilized Sn-Macroaggregated Albumin (Sn-MAA) kits to be labelled with ^{99m}Tc for lung perfusion scanning. The reaction vial contains a lyophilized suspension having the following components: 1,0mg of Aggregated Human Serum Albumin (MAA), 0,12mg of hydrated stannous chloride ($SnCl_2.2H_2O$), 5,0mg of Normal Human Serum Albumin (HSA) and 1% of Tween 80 as emulsifying agent. In this method the Sn-MAA kits were performed in a single step process, and a consistent suitable range of particle size (10-80 mu) was obtained. The size of the particles and the effect of storage time on the stability for the lyophilized kits were also investigated. The radiochemical purity, higher than 98% in ^{99m}Tc Macroaggregated was determined by using ascending paper chromatography (Whatman n.3 and 85% methanol): biodistribution studies in rats have shown the high uptake in the lungs 85%/D with low liver uptake 2%/d and lung-liver ratios 98 ± 1%. Excellent human lung images for clinical practice were obtained with these kits, which are prepared at IPEN-CNEN/SP for brazilian physicians. (author).

7141 (KAERI-II/RR–12/90) **Basic chemistry for radioactive waste management: Studies on the chemical behaviors of radioactive elements.** Park, Kyong Kyun (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Kim, Won Ho; Jee, Kwang Yong; Kim, Jong Goo; Park, Yeong Jae; Yu, Mahn Su; Jee, Choun Suk; Song, Byoung Chul; Choi, Ke Chon; Eom, Tae Yoon. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Mar 1991. 295p. (In Korean). Order Number DE92614888. Source: OSTI; NTIS (US Sales Only); INIS.

The complex formation between uranium(VI) ion and chloride ion in aqueous solution can be confirmed by UV-Vis absorption spectroscopy and differential pulse polarography. Absorption spectra and differential pulse polarograms of uranyl ion in hypochlorite/chloride media shows for its interaction with hypochlorite ion. Although the spectral changes for its interaction are ambiguous, new half-wave potential due to the interaction of uranium(VI)-hypochlorite ion appears in the differential pulse polarogram. Kinetic studies on the electron transfer reaction between U(IV) ion and Fe(III)(phen)3 complex in the solution containing dipicolinic acid or phosphoric acid show that the reaction rate slows down in low ligands concentration and speeds up in high ligands concentration. This result indicates that free functional group of multidentate ligands coordinated to U(IV) ion interacts at the 2 or 9 position carbon atom of phenanthroline ring in iron(III) complex. The presence of 5-sulfosalicylic acid slows down the electron transfer reaction between U(IV) ion and Fe(III) ion through the complex formation with two reactants. More information about the complex formation between U(IV) ion and 5-sulfosalicylic acid is needed for accurate explanation of the reaction mechanism. Both plutonium and uranium are extracted by TBP/dodecane from the aqueous solution, in which the post-irradiated nuclear fuel pellet is dissolved. They are back-extracted into 2M HCl solution after reducing plutonium(IV) ion to plutonium(III) ion by added U(IV) ion. Removing uranium on the DOWEX A-I anion exchange column, plutonium is eluted later for its purification. Gamma and alpha spectroscopic measurements shows the high decontamination factor and 95% recovery for the initial amounts of plutonium. (Author).

7142 (LBL–31347) **Design and operations at the National Tritium Labelling Facility.** Morimoto, H.; Williams, P.G. Lawrence Berkeley Lab., CA (United States). Sep 1991. 6p. Sponsored by National Institute for Occupational Safety and Health. DOE Contract AC03-76SF00098. Grant P41RR01237. (CONF-910920–9: 4. topical meeting on tritium technology in fission, fusion, and isotopic applications, Albuquerque, NM (United States), 30 Sep - 4 oct 1991). Order Number DE92004098. Source: OSTI; NTIS; INIS; GPO Dep.

The National Tritium Labelling Facility (NTLF) is a multipurpose facility engaged in tritium labeling research. It offers to the biomedical research community a fully equipped laboratory for the synthesis and analysis of tritium labeled compounds. The design of the tritiation system, its operations and some labeling techniques are presented.

4008 Combustion, Pyrolysis, and High-Temperature Chemistry

Refer also to citation(s) 6980, 7059

7143 (DOE/ER/13527–T1) **Premixed turbulent combustion: Progress report, 1 December 1990–30 November 1991.** Libby, P.A. California Univ., San Diego, La Jolla, CA (United States). Dept. of Applied Mechanics and Engineering Sciences. [1991]. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract FG03-86ER13527. Order Number DE92003763. Source: OSTI; NTIS; GPO Dep.

Short communication. TURBULENT FLOW/combustion; FLAMES/hydrodynamics; PROGRESS REPORT; COMBUSTION; LAMINAR FLOW; TURBULENCE; FLUID MECHANICS; FLAMES; HYDRODYNAMICS

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Refer also to citation(s) 6487

7144 (UCRL–53868-90, pp. 2.12-2.14) **NIKE3D development.** Maker, B.N. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

During FY 90, the authors enhanced the capabilities of their three-dimensional, implicit, nonlinear finite element code NIKE3D by adding several important features. To improve accuracy in nonlinear solutions to continuum and structural mechanics problems, they implemented the incompatible modes and YASE element formulations. To solve larger problems using less computer time, they added an element-by-element conjugate gradient solver. In order to model a larger class of material behavior they added new creep, anisotropic, and composite constitutive models. They also enhanced thermal and eigenvalue analysis capabilities, and included an interface to DYNA3D for static initialization of high-rate dynamic analyses. These enhancements have been documented in a comprehensive user's manual.

7145 (UCRL–53868-90, pp. 2.23-2.27) **A new coupled thermomechanical analysis code.** Engelmann, B.E.; Whirley, R.G. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

The authors have developed a new coupled thermomechanical analysis code called PALM2D. This new code solves for the coupled thermomechanical response of axisymmetric or plane strain solids, including nonlinear effects. The thermal problem may include temperature-dependent thermal conductivities and convection boundary conditions, and the mechanical problem may include large deformations and strains as well as material nonlinearities such as plasticity Coupling is achieved through a staggered-step formulation. Heat generation due to plastic work is included, and all heat-transfer computations are done on the deformed geometry. PALM2D is a rapidly evolving code, and they expect many enhancements in the near future.

7146 (UCRL–53868-90, pp. 3.17-3.20) **Scaling basic kinematic machines to micron dimensions.** Ciarlo, D.R.; Folta, J.A.; Orvis, W.J. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

The authors have begun working in microdynamics, a new field of engineering in which integrated circuit technology is used to fabricate miniature mechanical devices with movable parts. They designed and fabricated a microstructure to test their abilities in microfabrication techniques. Their test bed structure is an array of miniature cantilever beams that can be electrostatically deflected and used in laser scanning systems. They have established that the microbeams are deflected by electrostatic forces, and have successfully tested them with waveforms up to 1 kHz.

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Refer also to citation(s) 6362, 6365, 6438, 6449, 6478, 6609, 6649, 6650, 6752, 6836, 6848, 6945, 6956, 7130, 7142, 7255, 7512, 7523, 7859, 7862, 8386

7147 (ANL/CP–73489) **Seismic isolation systems designed with distinct multiple frequencies.** Wu, Ting-shu; Seidensticker, R.W. Argonne National Lab., IL (United States). [1991]. 12p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. (CONF-911213–18: American Society of Mechanical Engineers (ASME) annual winter meeting, Atlanta, GA (United States), 1-6 Dec 1991). Order Number DE92004151. Source: OSTI; NTIS; INIS; GPO Dep.

Two systems for seismic base isolation are presented. The main feature of these system is that, instead of only one isolation frequency as in conventional isolation systems, they are designed to have two distinct isolation frequencies. When the responses during an earthquake exceed the design value(s), the system will automatically and passively shift to the secondly isolation frequency. Responses of these two systems to different ground motions including a harmonic motion with frequency same as the primary isolation frequency, show that no excessive amplification will occur. Adoption of these new systems certainly will greatly enhance the safety and reliability of an isolated superstructure against future strong earthquakes. 3 refs.

7148 (CONF-9109217–2) **SAS1 and SAS4, two new shielding analysis sequences for spent fuel casks.** Broadhead, B.L.;

Tang, J.S.; Parks, C.V. Oak Ridge National Lab., TN (United States). [1991]. 13p. Sponsored by U.S. DOE Radioactive Waste Management; Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. From Seminar on SCALE-4 and related modular systems for the evaluation of nuclear fuel facilities and package design featuring criticality, shielding and heat transfer capabilities; Gif-sur-Yvette (France); 17-20 Sep 1991. Order Number DE92005122. Source: OSTI; NTIS; INIS; GPO Dep.

Two important Shielding Analysis Sequences (SAS) have recently been developed within the SCALE computational system. These sequences significantly enhance the existing SCALE system capabilities for evaluating radiation doses exterior to spent fuel casks. These new control module sequences (SAS1 and SAS4) and their capabilities are discussed and demonstrated. Particular attention is given to the new SAS4 sequence which provides an automated scheme for generating and using biasing parameters in a subsequent Monte Carlo analysis of a cask.

7149 (DOE/NE/37967–T7) **A remote telepresence robotic system for inspection and maintenance of a nuclear power plant: DOE/NE program in robotics for advanced reactors: Annual research status report, 1991.** Crane, C.D. III; Tulenko, J.S. Florida Univ., Gainesville, FL (United States). 15 Dec 1991. 69p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract FG02-86NE37967. Order Number DE92004944. Source: OSTI; NTIS; INIS; GPO Dep.

This annual report details the activities of the University of Florida research on the robotic system for inspection and maintenance of nuclear power plants. (FI)

7150 (DOE/NE/37969–3) **DOE Robotics Project: Summary of progress for 1991.** Michigan Univ., Ann Arbor, MI (United States). Jan 1991. 64p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract FG02-86NE37969. Order Number DE92004760. Source: OSTI; NTIS; GPO Dep.

This document provide the bimonthly progress reports on the Department of Energy (DOE) Robotics Project by the University of Michigan. Reports are provided for the time periods of December 90/January 91 through June 91/July 91. (FI)

7151 (ES/CSET–11) **Natural phenomena application guide, Phase 2: Safety Analysis Report Update Program.** Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States). Nov 1991. 24p. Sponsored by U.S. DOE Environment Safety & Health. DOE Contract AC05-84OR21400. Order Number DE92003962. Source: OSTI; NTIS; GPO Dep.

The evaluation of the effects of natural phenomena loading on the safety of facility operation is an identified requirement of facility safety analysis. Department of Energy guidance pertinent to the evaluation of the response of facilities to natural phenomena are summarized in this application guide. This document is written to provide guidance to the participants in performing the evaluations. The response of facilities to natural phenomena loading will be evaluated for portions of those facilities that are tentatively identified as moderate or high hazard and for associated low hazard portions along with possible interactions with adjacent facilities. The natural phenomena evaluation requires the integrated efforts of the facility operators, safety analyst, and structural analyst. This document describes interfaces important to this integration. It also provides specific guidance to the structural analyst. This guidance is in the form of magnitude of loading, evaluation methodology, applicable codes and standards and content of the report to be produced.

7152 (INIS-mf–13026, pp. 317-318) **Quarter wave resonator design.** Srinivasan, B. (Bhabha Atomic Research Centre, Bombay (India). Nuclear Physics Div.); Pillay, R.G. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. RESONATORS/specifications; DRIFT TUBES; ELECTRIC FIELDS; ELECTRIC POTENTIAL; RESONATORS; SPECIFICATIONS; WAVE PROPAGATION

7153 (KCP–613-4529) **Clean room wiping liquids.** Harding, W.B. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. Dec 1991. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00613. Order Number DE92004793. Source: OSTI; NTIS; GPO Dep.

A water-based liquid containing isopropyl alcohol, ammonium hydroxide, and surfactants was developed to replace 1,1,2-trichlorotrifluoroethane for the dampening of clean room wiping cloths used to wipe clean benches, clean room equipment, and latex finger cots and gloves.

7154 (KCP–613-4621) **Computer-aided process planning: Development of an expert process planning system: Final report.** Brooks, S.L.; Hummel, K.E.; Wolf, M.L. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. Dec 1991. 42p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00613. Order Number DE92004880. Source: OSTI; NTIS; GPO Dep.

The project utilizes artificial intelligence (AI) technology to develop an expert system that will be used to prepare production plans, to automatically make cutting tool selections, and to automatically define machinability parameters and NC tape requirements. The expert system, XCUT, can plan features on moderately complex prismatic machined parts and reduce 2 to 4 hours of manual process effort into 15 or 30 minutes. Areas of future work have been identified that will enable the XCUT system to be used for production. These areas where further development is required are geometric reasoning, representation of manufacturing features, dimensioning and tolerancing, feature extraction, distributed computing architecture, knowledge gathering, and user interfaces.

7155 (KCP–613-4643) **Combining noise factors and process parameters in a response surface.** Wyckoff, J. Allied-Signal Aerospace Co., Kansas City, MO (United States). Kansas City Div. Nov 1991. 23p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00613. (CONF-9108100–7: American Statistical Association (ASA) annual meeting, Atlanta, GA (United States), 18-22 Aug 1991). Order Number DE92003739. Source: OSTI; NTIS; GPO Dep.

This paper covers the strategy and analysis of an experiment to characterize a gas tungsten arc welding process. The experiment combined four non-controlled product features, or noise factors, and four controlled process parameters. A non-traditional response surface design was employed. Multiple responses were modeled. Optimal settings for the process parameters to successfully weld the widest range of the pertinent product features were identified. Thus, the process was made "robust" against "noise" factors. Comparisons are made between the experimental and analytical approach taken versus the Taguchi style of experimentation and analysis. This comparison is mainly done with respect to the information gained, such as product design criteria, incoming material specifications, and process adjustments for non-conforming material. 11 figs., 3 tabs.

7156 (KFK–4850, pp. 117-126) **Venting filter for LWR.** Dillmann, H.G. (Kernforschungszentrum Karlsruhe GmbH (Germany). Lab. fuer Aerosolphysik und Filtertechnik 2); Pasler, H.; Schmitt, H.; Bleier, K. Kernforschungszentrum Karlsruhe GmbH (Germany). Projekt Nukleare Sicherheitsforschung. Jul 1991. (In German). In *Safety oriented LWR research. Annual report 1990.* 270p. Order Number DE92758922. Source: OSTI; NTIS (US Sales Only); INIS.

1990 two tests have been done successfully in France at the Fuchia-loop with CsOH loading of metal fiber filters. A filter modul is tested with a back flow to see the effect in the efficiency after such an event. The thermal capability has been testet for the time after the venting process with no cooling gas stream. Downstream of the multistage fiber filter unit a second filter unit is used with a binary doped zeolith as the sorbens for elementary iodine removal. Also methyl iodine is retained. The removal efficiency and the catalytic behaviour with regard to the H_2/O_2-reaction are indicated. The test methods are described. (orig.).

7157 (KFK–4850, pp. 127-130) **HEPA filter response to accident conditions.** Neuberger, M. (Kernforschungszentrum Karlsruhe GmbH (Germany). Lab. fuer Aerosolphysik und Filtertechnik

2); Fronhoefer, M.; Hardy, T.; Kuhn, W.; Ricketts, C.I. Kernforschungszentrum Karlsruhe GmbH (Germany). Projekt Nukleare Sicherheitsforschung. Jul 1991. (In German). In *Safety oriented LWR research. Annual report 1990.* 270p. Order Number DE92758922. Source: OSTI; NTIS (US Sales Only); INIS.

To guarantee the integrity of new, high-strength HEPA filters over a long time a number of experiments in the ventilation systems of KfK and on a vibration table - to simulate the transport of the filters - were conducted. Following tests show no penetration. Oscillating motions of samples of filter media with and without tears show no damages to the papers. A loss of integrity of the filters by stress over a long time so can be excluded. The theoretical modelling of the Δp increases of filters exposed to fog conditions was continued. A good agreement between theoretical and experimental values was obtained. (orig.).

7158 (KFK–4850, pp. 131-139) **Challenges within ventilation systems during accident situations.** Neuberger, M. (Kernforschungszentrum Karlsruhe GmbH (Germany). Lab. fuer Aerosolphysik und Filtertechnik 2); Bletzer, P.; Fronhoefer, M.; Hardy, T.; Kuhn, W.; Ricketts, C.I.; Schmidmeier, K.H. Kernforschungszentrum Karlsruhe GmbH (Germany). Projekt Nukleare Sicherheitsforschung. Jul 1991. (In German). In *Safety oriented LWR research. Annual report 1990.* 270p. Order Number DE92758922. Source: OSTI; NTIS (US Sales Only); INIS.

To help estimate the mechanical loading at the service location two fluid dynamic codes were investigated. FLOWMASTER shows good results in generating the air-cleaning network and in calculating steady state conditions, but fails in calculating fluid dynamic transients. PROMO is very time consuming in generating the network, but one can obtain good results in calculating fluid dynamic transients. In addition to the challenges posed by elevated pressure, temperature, and air flow, the effects of shock waves, caused by explosions or hydrogen detonations must be considered. The problem of a 'shock-shock' in the flow after the diverging channel by high shock strengths were solved. In order to guarantee the safety margins of filter units during their entire service lives, filter performance needs to be verified under standardized test conditions that take into consideration the particularly adverse effects of filter exposure to super-saturated airflows and elevated differential pressure. The detail construction for a rig to type test filter units under fog conditions and increased pressure drop was finished, and the components of the test facility were chosen. (orig./DG).

7159 **Fiber optic mounted laser driven flyer plates.** Paisley, D.L. To Dept. of Energy. 1990. Filed date 2 Apr 1990. USA Patent patent application 7-502,960. 10p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE92003835. Source: OSTI; NTIS; GPO Dep.

This invention is comprised of a laser driven flyer plate where the flyer plate is deposited directly onto the squared end of an optical fiber. The plasma generated by a laser pulse drives the flyer plate toward a target. In another embodiment, a first metal layer is deposited onto the squared end of an optical fiber, followed by a layer of a dielectric material and a second metal layer. The laser pulse generates a plasma in the first metal layer, but the plasma is kept away from the second metal layer by the dielectric layer until the pressure reaches the point where shearing occurs. 2 figs.

7160 **System and method for exchanging tools and end effectors on a robot.** Burry, D.B.; Williams, P.M. To Dept. of Energy. 1990. Filed date 2 Apr 1990. USA Patent patent application 7-502,962. 29p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC34-90DP62349. Order Number DE92003836. Source: OSTI; NTIS; GPO Dep.

This invention is comprised of a system and method for exchanging tools and effectors on a robot permits exchange during a programmed task. The exchange mechanism is located off the robot, thus reducing the mass of the robot arm and permitting smaller robots to perform designated tasks. A simple spring/collet mechanism mounted on the robot is used which permits the engagement and disengagement of the tool or end effector without the need for a rotational orientation of the tool to the end effector/collet interface. As the tool changing system is not located on the robot arm no umbilical cords are located on robot.

7161 **Conduit grinding apparatus.** Nachbar, H.D.; Korytkowski, A.S. To Dept. of Energy. 1990. Filed date 3 Apr 1990. USA Patent patent application 7-504,152. 11p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC12-76SN00052. Order Number DE92003837. Source: OSTI; NTIS; GPO Dep.

This invention is comprised of a grinding apparatus for grinding the interior portion of a valve stem receiving area of a valve. The apparatus comprises a faceplate, a plurality of cams mounted to an interior face of the faceplate, a locking bolt to lock the faceplate at a predetermined position on the valve, a movable grinder and a guide tube for positioning an optical viewer proximate the area to be grinded. The apparatus can either be rotated about the valve for grinding an area of the inner diameter of a valve stem receiving area or locked at a predetermined position to grind a specific point in the receiving area.

7162 **Precision wire feeder for small diameter wire.** Brandon, E.D.; Hooper, F.M.; Reichenbach, M.L. To Dept. of Energy. 1990. Filed date 9 Apr 1990. USA Patent patent application 7-506,126. 14p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE92003842. Source: OSTI; NTIS; GPO Dep.

This invention is comprised of a device for feeding small diameter wire having a diameter less than .04 mm (16 mil) to a welding station which includes a driving wheel for controllably applying a non-deforming driving force to the wire to move the free end of the wire towards the welding station; and a tension device such as a torque motor for constantly applying a reverse force to the wire in opposition to the driving force to keep the wire taut. 1 fig.

7163 **Hot cell examination table.** Gaal, P.S.; Ebjer, L.P.; Kareis, J.H.; Schlegel, G.L. To Dept. of Energy. 1990. Filed date 27 Apr 1990. USA Patent patent application 7-515,307. 15p. Sponsored by National Aeronautics and Space Administration. Contract N00024-79C-4026. Order Number DE92004605. Source: OSTI; NTIS; GPO Dep.

This invention is comprised of a table for use in a hot cell or similar controlled environment for use in examining specimens. The table has a movable table top that can be moved relative to a table frame. A shaft is fixedly mounted to the frame for axial rotation. A shaft traveler having a plurality of tilted rollers biased against the shaft is connected to the table top such that rotation of the shaft causes the shaft traveler to roll along the shaft. An electromagnetic drive is connected to the shaft and the frame for controllably rotating the shaft.

7164 **Automatic feed system for ultrasonic machining.** Calkins, N.C. To Dept. of Energy. 1990. Filed date 11 May 1990. USA Patent patent application 7-522,016. 12p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE92004614. Source: OSTI; NTIS; GPO Dep.

This invention is comprised of a method and apparatus for ultrasonic machining in which feeding of a tool assembly holding a machining tool toward a workpiece is accomplished automatically. In ultrasonic machining, a tool located just above a workpiece and vibrating in a vertical direction imparts vertical movement to particles of abrasive material which then remove material from the workpiece. The tool does not contact the workpiece. Apparatus for moving the tool assembly vertically is provided such that it operates with a relatively small amount of friction. Adjustable counterbalance means is provided which allows the tool to be immobilized in its vertical travel. A downward force, termed overbalance force, is applied to the tool assembly. The overbalance force causes the tool to move toward the workpiece is material is removed from the workpiece.

7165 **Valve stem and packing assembly.** Wordin, J.J. To Dept. of Energy. 1990. Filed date 31 May 1990. USA Patent patent application 7-531,487. 19p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-84ID12435. Order Number DE92003777. Source: OSTI; NTIS; GPO Dep.

A valve stem and packing assembly is provided in which a rotatable valve stem includes a first tractrix surface for sliding contact with a stem packing and also includes a second tractrix surface for sliding contact with a bonnet. Force is applied by means of a spring, gland flange, and gland on the stem packing so the stem packing seals to the valve stem and bonnet. This configuration serves to create and maintain a reliable seal between the stem packing and the valve stem. The bonnet includes a second complementary tractrix surface for contacting the second sliding tractrix surface, the combination serving as a journal bearing for the entire valve stem and packing assembly. The journal bearing so configured is known as a Schiele's pivot. The Schiele's pivot also serves to maintain proper alignment of the valve stem with respect to the bonnet. Vertical wear between the surfaces of the Schiele's pivot is uniform at all points of contact between the second sliding tractrix surface and the second complementary tractrix surface of a bonnet. The valve stem is connected to a valve plug by means of a slip joint. The valve is opened and closed by rotating the valve stem. The slip joint compensates for wear on the Schiele's pivot and on the valve plug. A ledge is provided on the valve bonnet for the retaining nut to bear against. The ledge prevents overtightening of the retaining nut and the resulting excessive friction between stem and stem packing.

7166 Method and apparatus for continuous flow injection extraction analysis. Harkenstein, S.D.; Siemer, D.D. To Dept. of Energy. 1990. Filed date 8 Jun 1990. USA Patent patent application 7-534,897. 17p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-84ID12435. Order Number DE92003743. Source: OSTI; NTIS; GPO Dep.

A method and apparatus for a continuous flow injection batch extraction analysis system is disclosed employing extraction of a component of a first liquid into a second liquid which is a solvent for a component of the first liquid, and is immiscible with the first liquid, and for separating the first liquid from the second liquid subsequent to extraction of the component of the first liquid. 1 fig.

7167 Miniaturized pressurization system. Whitehead, J.C.; Swink, D.G. To Dept. of Energy. 1990. Filed date 9 Jul 1990. USA Patent patent application 7-550,280. 22p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE92003821. Source: OSTI; NTIS; GPO Dep.

This invention relates to pressurization systems and liquid rocket propulsion systems, and particularly to those used to attitude control or maneuvering of small space vehicles or airborne vehicles where the requirement for thrust is intermittent rather than continuous, and must be available rapidly upon demand. This invention also relates to increasing performance of such propulsion systems, by way of eliminating inert mass from the propulsion system. The invention uses a fluid stored at a low pressure and provides the fluid at a high pressure. The invention allows the low pressure fluid to flow to a fluid bore of a differential pump and from the pump to a fluid pressure regulator. After flowing through the regulator the fluid is converted to a gas which is directed to a gas bore of the differential pump. By controlling the flow of gas entering and being exhausted from the gas bore, the invention provides pressure to the fluid. By setting the regulator, the high pressure fluid can be set at predetermined values. Because the invention only needs a low pressure fluid, the inventive apparatus has a low mass, and therefore would be useful in rocket propulsion systems.

7168 A method and apparatus for continuous electrophoresis. Watson, J.S. To Dept. of Energy. 1990. Filed date 10 Jul 1990. USA Patent patent application 7-551,387. 22p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE92003822. Source: OSTI; NTIS; GPO Dep.

A method and apparatus for conducting continuous separation of substances by electrophoresis are disclosed. The process involves electrophoretic separation combined with couette flow in a thin volume defined by opposing surfaces. By alternating the polarity of the applied potential and producing reciprocating short rotations of at least on of the surfaces relative to the other, small increments of separation accumulate to cause substantial, useful segregation of electrophoretically separable components in a continuous flow system.

7169 (RFP–4488) **In-place calibration of glovebox differential pressure gauges.** Abercrombie, K.R. EG and G Rocky Flats, Inc., Golden, CO (United States). Rocky Flats Plant. 2 Oct 1991. 4p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC34-90DP62349. Order Number DE92004799. Source: OSTI; NTIS (US Sales Only); GPO Dep.

In November 1989, concern about the health and safety of workers and the environment halted plutonium operations at the Rocky Flats Plant (RFP). As a result, it became necessary to certify the instrumentation used to monitor and control conditions at the plant affecting health, safety, and the environment. Many of these Vital Safety Systems (VSS) had never been calibrated. Glovebox differential pressure gauges are one example of VSS instrumentation that had never been certified. The RFP Standards Laboratory was requested to develop a method to certify these gauges. After examining several options, it was decided to replace existing gauges with new, certified gauges and incorporate a three-way valve and filter to allow recalibration. This system has been in place for one year. Recent recalibration of 78 gauges, in place, demonstrates that this method meets or exceeds all expectations.

7170 (RFP–4509) **Low-cost teleoperator-controlled vehicle for damage assessment and radiation dose measurement.** Tyree, W.H. EG and G Rocky Flats, Inc., Golden, CO (United States). Rocky Flats Plant. [1991]. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC34-90DP62349. (CONF-911106–20: IEEE nuclear science symposium, Santa Fe, NM (United States), 5-9 Nov 1991). Order Number DE92003637. Source: OSTI; NTIS; INIS; GPO Dep.

A low-cost, disposable, radio-controlled, remote-reading, ionizing radiation and surveillance teleoperator re-entry vehicle has been built. The vehicle carries equipment, measures radiation levels, and evaluates building conditions. The basic vehicle, radio control with amplifiers, telemetry, elevator, and video camera with monitor cost less than $2500. Velcro-mounted alpha, beta-gamma, and neutron sensing equipment is used in the present system. Many types of health physics radiation measuring equipment may be substituted on the vehicle. The system includes a black-and-white video camera to observe the environment surrounding the vehicle. The camera is mounted on a vertical elevator extendible to 11 feet above the floor. The present vehicle uses a video camera with an umbilical cord between the vehicle and the operators. Preferred operation would eliminate the umbilical. Video monitoring equipment is part of the operator control system. Power for the vehicle equipment is carried on board and supplied by sealed lead-acid batteries. Radios are powered by 9-V alkaline batteries. The radio control receiver, servo drivers, high-power amplifier and 49-MHz FM transceivers were irradiated at moderate rates with neutron and gamma doses to 3000 Rem and 300 Rem, respectively, to ensure system operation.

7171 (SAND–91-1064) **Certification testing of the Los Alamos National Laboratory Heat Source/Radioisotopic Thermoelectric Generator shipping container.** Bronowski, D.R.; Madsen, M.M. Sandia National Labs., Albuquerque, NM (United States). Sep 1991. 113p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (TTC–1071). Order Number DE92003340. Source: OSTI; NTIS; INIS; GPO Dep.

The Heat Source/Radioisotopic Thermoelectric Generator shipping counter is a Type B packaging currently under development by Los Alamos National Laboratory. Type B packaging for transporting radioactive material is required to maintain containment and shielding after being exposed to normal and hypothetical accident environments defined in Title 10 of the Code of Federal Regulations Part 71. A combination of testing and analysis is used to verify the adequacy of this packaging design. This report documents the testing portion of the design verification. Six tests were conducted on a prototype package: a water spray test, a 4-foot normal conditions drop test, a 30-foot drop test, a 40-inch puncture test, a 30-minute thermal test, and an 8-hour immersion test.

7172 (SAND–91-2204) **Transportation environments of the AL-SX (H1616).** York, A.R. II. Sandia National Labs., Albuquerque, NM (United States). Nov 1991. 76p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE92004783. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Tritium gas reservoirs are often transported to a weapon as an individual component packaged in a radioactive materials transportation container. A new transportation container, the AL-SX, has been certified by the Nuclear Explosive Safety Division of the Department of Energy to meet Title 10, Part 71 of the Code of Federal Regulations for transport of radioactive material. The gas reservoir provides containment of tritium gas during normal operating conditions for the AL-SX/2 and the AL-SX/3 (without a tritium getter). It is important to know the environments that the reservoir experiences during shipment to determine if there are any effects on its safety or reliability. This report defines environments and test specifications that may be used to qualify normal transportation environments for reservoirs. Also, a summary of vibration/shock and thermal test results is presented for a few reservoirs that have limiting features (e.g., maximum decay heat, maximum weight, etc.).

7173 (UCID–21756) **Corrosion models for predictions of performance of high-level radioactive-waste containers.** Farmer, J.C. (Lawrence Livermore National Lab., CA (United States)); McCright, R.D.; Gdowski, G.E. Lawrence Livermore National Lab., CA (United States). 1 Nov 1991. 41p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract W-7405-ENG-48. Order Number DE92004467. Source: OSTI; NTIS; INIS; GPO Dep.

The present plan for disposal of high-level radioactive waste in the US is to seal it in containers before emplacement in a geologic repository. A proposed site at Yucca Mountain, Nevada, is being evaluated for its suitability as a geologic repository. The containers will probably be made of either an austenitic or a copper-based alloy. Models of alloy degradation are being used to predict the long-term performance of the containers under repository conditions. The models are of uniform oxidation and corrosion, localized corrosion, and stress corrosion cracking, and are applicable to worst-case scenarios of container degradation. This paper reviews several of the models.

7174 (UCRL-CR–105696) **LLNL evaluation of the Portacount for determining respirator fit factors.** Biermann, A.H.; da Roza, R.A.; Foote, K.L.; McCormack, C.E.; Sackett, C.R.; Sawyer, S.R. Lawrence Livermore National Lab., CA (United States). Oct 1991. 58p. Sponsored by U.S. Department of Labor. DOE Contract W-7405-ENG-48. Order Number DE92004666. Source: OSTI; NTIS; GPO Dep.

We investigated the use of a portable condensation nucleus counter (the model 8010 Portacount by TSI, Inc.) as a detector for quantitative fit testing of respirators. Fit test results were compared with measurements using an aerosol photometer, which is the instrument of choice for quantitative fit testing of respirators. In the first phase of this study, simultaneous measurements were made with the two instruments using a mannequin head and breathing machine to test the instrumentation without the added variability of human test subjects. The second phase of the study involved characterizing the aerosols in the ambient environment, calculating the effect of fine particles generated by human breathing, and comparing the fit test results obtained by the Portacount and the photometer from human test subjects. The third phase of the study was the production of a supplementary manual of special instructions for using the Portacount, such as the application limit of the instrument, start-up procedure, data collection, and maintenance. In the first phase of our experiment, we fitted a mannequin head with an MSA Ultravue full-face respirator. The fit factors as measured by the Portacount and photometer were compared at several different simulated leak conditions. Two challenge aerosols were selected for these in investigations: an oil mist aerosol and the ambient room aerosol. The oil mist aerosol is similar to that routinely used in fit tests using the photometer as the detector. The room aerosol was of interest because the Portacount can be used with less-concentrated aerosols due to its greater sensitivity. The second phase of our study, which used human subjects, found results that were in agreement with the mannequin/breathing-machine results. The fit testing involved 10 human subjects using the eight exercises from the OSHA asbestos standard.

7175 (UCRL-ID–108596) **Implementation of the J-integral option in NIKE2D.** Zywicz, E. Lawrence Livermore National Lab., CA (United States). 1 Jul 1991. 28p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE92004625. Source: OSTI; NTIS; GPO Dep.

Numerical procedures have been incorporated into the finite-deformation finite element (FE) code NIKE2D to extract fracture mechanics parameters directly from the equilibrium solution. The domain integral implementation permits the energy release rate, as measured by the J-Integral to be evaluated under static states from general (non-isothermal) conditions and for restricted thermal conditions. Thermal J extractions are limited to material systems which posses a linearly elastic dilatational response. A mode mixity separation technique, based upon energy interaction integrals, is implemented for planar geometries and permits the mode 1 and 2 components of the static stress intensity factors to be calculated for both homogeneous isotropic elastic and isotropic elastic interfacial cracks. The small-strain mode separation method includes an optional compensator which accounts for large rigid-body crack-tip rotations. User input is minimized because the implementation automatically determines the integration domains from the user specified crack-tip nodes. Several example problems demonstrate the various features and overall accuracies. 31 refs., 4 figs., 6 tabs.

7176 (UCRL-JC–108589) **Applications of intelligent telerobotic control.** Herget, C.J.; Grasz, E.L.; Merrill, R.D. Lawrence Livermore National Lab., CA (United States). Oct 1991. 7p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract W-7405-ENG-48. Order Number DE92004655. Source: OSTI; NTIS; GPO Dep.

The telerobotics laboratory at Lawrence Livermore National Laboratory is a facility for developing and testing new concepts in robotics controls. Research and development is being conducted in computer vision; adaptive control; software architectures for real-time, intelligent control; artificial neural networks; fuzzy logic controllers; telepresence; and path planning and collision avoidance. The equipment in the telerobotics laboratory includes a six degree of freedom articulating robot arm with controller, gripper, and force and torque sensor; a 3D CAD workstation with software to model the work cell environment and simulate the robot dynamics; a six degree of freedom forceball for operator input to the telerobotics controller and the robot simulation; and a computer with a real-time operating system. Soon to be added are a 3D viewing system and a force reflecting hand controller. This paper describes one of the research and development efforts currently in progress on this program. 3 refs., 3 figs.

7177 (UCRL-JC–108735) **Hardening automated equipment for hostile environments.** Allen, D.C. (Lawrence Livermore National Lab., CA (United States)); Hayward, M.; Sievers, R.H.; Cook, L. Lawrence Livermore National Lab., CA (United States). Nov 1991. 13p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-911107–48: Winter meeting of the American Nuclear Society (ANS), San Francisco, CA (United States), 10-15 Nov 1991). Order Number DE92004669. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Lawrence Livermore National Laboratory (LLNL) is developing robotic systems suited to replacing human operations involving the processing of radioactive materials within glove boxes. The glove box enclosures contain a variety of hostile environmental factors that are deleterious to standard commercial robotic components. In addition to the high alpha activity encountered inside the enclosure, the equipment is expected to operated in dusty conditions with a high hardness dust. The gaseous environments include very low concentrations of oxygen and moisture within an inert nitrogen or argon fill. The radiation and the other environmental factors can be hostile to electronics, electrical-mechanical systems, and the materials of which they are composed. The developmental robotic system incorporates materials and components especially selected for improved resistance to these environments. A small commercial overhead gantry robot, the IBM electrical cantilevered robot, was modified and hardened for plutonium processing applications in a glove box. The robotic components are being tested for survivability by operating in a sealed glove box and by testing selected items separately. The results of the developmental effort are projected to be generic and suited to a wide range of DOE special nuclear material processing and system production applications.

4204 Heat Transfer and Fluid Flow

Refer also to citation(s) 6298, 6583, 6584, 6692, 7223, 7481

7178 (CONF-9106303–, pp. 126-127) **Mechanics/heat transfer relation for particle flows.** Campbell, C.S. (Univ. of Southern California, Los Angeles (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-88PC88913. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The objective is to understand the links between the mechanical behavior of a two phase mixture and its heat transfer behavior in a manner akin to Reynolds' analogy that has been long been established for simple fluids. The project studies two systems. The first is simple shear rheometers, which has clearly established a link between the apparent viscosity and thermal conductivity of dry particle flows. The second is to study fluidized beds with the intent to establish a link between the heat transfer behavior and an internal property called the 'particle pressure'. Unfortunately, no such link has been found for the latter problem and the investigation has turned toward examining the rheology of the particle pressure itself. It has been observed that bubbles generate the largest portion of the particle pressure in a gas-fluidized bed. Nearly all of the processing of fossil fuels involves chemical reactions in particle-fluid systems of one form or another, whether they be synthetic fuel retorts or basic fluidized bed crackers. All chemical processes require the addition or removal of heat in order to maintain the reaction process. Hence, understanding the relationship between the state of motion of the multiphase system and its heat transfer properties could strongly influence future designs. Furthermore, the program studying particle pressures is relevant to many studies of multiphase systems that use such quantities in mathematical modeling.

7179 (DOE/ER/13913–4) **Study of interfacial behavior in cocurrent gas-liquid flows: Progres report, November 1, 1990–October 31, 1991.** McCready, M.J. Notre Dame Univ., IN (United States). Dept. of Chemical Engineering. Nov 1991. 19p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER13913. Order Number DE91019081. Source: OSTI; NTIS; GPO Dep.

From video images of the interface of a gas-sheared liquid layer at conditions moving away from neutral stability, a mechanism by which the two-dimensional wave field becomes unstable to transverse disturbances has been observed. It is seen that the first transverse variation is caused by a varicose instability in which two oblique modes with transverse wavenumbers $\pm k_y$ ($k_y=2\pi/\lambda_y$), and streamwise wavenumber, k_x, equal to the fundamental, appear simultaneously. Two-dimensional Fourier-Transforms show that k_y is 0 for the 2-D case (as expected) but moves off axis to a value of k_y which corresponds to a wavelength of about 5-10 cm when transverse variation is observed. A theoretical analysis based on an integral boundary-layer analysis of the Navier-Stokes equations agrees with the observed mechanism of transverse instability of finite amplitude two-dimensional waves – at least for the conditions of the experiment. Because the theory is limited to conditions where the long wavelength, small amplitude assumptions are valid, and also because no viscous boundary conditions are presently included at the side walls of our 30.5 cm wide channel, it is not known if this a generic result. Experiments are planned to investigate this further; we are presently working on a more general theory which will remove the long wavelength restriction.

7180 (EUR–13588) **CEC thermal-hydraulic benchmark exercise on Fiploc verification experiment F2 in Battelle model containment long-term heat-up phase. Results for phase I.** Fischer, K. (Battelle Institut E.V., Frankfurt am Main (DE)); Schall, M.; Wolf, L. Commission of the European Communities, Luxembourg (Luxembourg). 1991. 86p. Contract No ETSN-0045/D. Source: OSTI; NTIS (US Sales Only).

The major objective of the F2 experiment was to investigate the thermal-hydraulic long-term phenomena with special emphasis on natural convection phenomena in a loop-type geometry affected by variations of steam and air injections at different locations as well as dry energy supply into various compartments. The open post-test exercise is being performed in two consecutive phases, with Phase I covering the initial long-term heat-up phase. The exercise received widespread international attention with nine organizations from six European countries participating with seven different computer codes (FUMO, Jericho2, Fiploc, Wavco, Contain, Melcor, Cobra/Fathoms). These codes cover a broad spectrum of presently known European computational tools in severe accident containment analyses. The participants used either the specified mass flow or pressure control boundary conditions. Some exercised their codes for both. In total, 14 different computations were officially provided by the participants indicating strong interests and cooperative efforts by various institutions.

7181 (KAERI/RR–980/90) **Improvement of analysis system for core thermal hydraulic field and CHF.** Hwang, Dae Hyun (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Park, Jong Ryul; Chun, Tae Hyun; Hong, Seung Dug; Kwon, Hyuk Sung. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Mar 1991. 100p. (In Korean). Order Number DE92615043. Source: OSTI; NTIS (US Sales Only); INIS.

The objectives of this research are to establish the analysis system of thermal hydraulic field of KOFA(Korean Fuel Assembly) core using the multichannel analysis code TORC, and to improve the analysis system for critical heat flux (CHF) according to the multichannel analysis system. The thermal hydraulic models included in TORC code were reviewed, and the value of turbulent mixing parameter, which was found to be the most sensitive parameter to the variation of fuel assembly geometry, was determined from the thermal mixing test data of KOFA. The performance of the existing CHF correlations were evaluated through the CHF test data of KOFA using the TORC code models which were adjusted to KOFA. Furthermore, new CHF correlations were developed to improve the performance of CHF analysis system by using TORC code. In addition, the model for the evaluation of transition core DNBR penalty using TORC code was developed, and the application of that model for Ulchin 1/2 mixed core of KOFA and FRA-STD FA shows that about 2% of DNBR margin can be recovered in the transition core. (Author).

7182 (KFK–4850, pp. 109-116) **Investigation of phase transport mechanisms in air-water bubbly flow in vertical channels.** Class, G. (Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Reaktorentwicklung (IRE)); Eberle, F.; Gering, G.; Kruse, H.; Meyder, R.; Philipp, P.; Lang, G.; Sengpiel, W. Kernforschungszentrum Karlsruhe GmbH (Germany). Projekt Nukleare Sicherheitsforschung. Jul 1991. (In German). In *Safety oriented LWR research. Annual report 1990.* 270p. Order Number DE92758922. Source: OSTI; NTIS (US Sales Only); INIS.

Experiments are performed at the NOVA two-phase flow test facility for investigation of the interfacial momentum exchange phenomena which result in characteristic spatial phase distributions in bubbly two-phase flow through vertical channels. They are part of two-phase flow research aiming at the capability of flow pattern analysis by adequate two-phase flow models. In the frame of the NOVA test matrix, experiments have been performed with upward and downward bubbly flows which show clearly the very distinctive development of spatial phase distributions along the test channel as a result of predominant lift forces. For measurement of turbulent static pressure in the liquid phase, the radial profile of which may have an influence on bubble migration, a static pressure probe has been developed. First measurements of static pressure profiles showed qualitatively good results. (orig./DG).

7183 (KFK–4920) **On the propagation of weak shock waves in air cleaning systems.** Neuberger, M. Kernforschungszentrum Karlsruhe GmbH (Germany). Lab. fuer Aerosolphysik und Filtertechnik (LAF); Kernforschungszentrum Karlsruhe GmbH (Germany). Projekt Nukleare Sicherheitsforschung; Essen Univ. (Gesamthochschule) (Germany). Fachbereich 12 - Maschinentechnik. Aug 1991. 135p. (In German). Order Number DE92750156. Source: OSTI; NTIS (US Sales Only); INIS.

In order to be able to calculate HEPA filter margins, both the mechanical loading at the service location and the structural strength of the filter unit must be known. This makes necessary the development of suitable computer codes for modelling fluid dynamic transients and, for extreme accidents, the propagation of weak shock waves. So the interaction of a shock wave with a junction of a straight duct having a side branch is considered. The paper checks the validity of two hypotheses. The first one calculates the shock waves after the junctions only by a geometrical consideration. A comparison with experimental values shows only an unsatisfactory result for weak shock waves. The second theory assumes that the pressure drop across the junction, in the quasi-steady flow which takes place after the incident shock waves, is the same as in steady flow tests. The pressure drops were measured for different junctions and the results of the calculation were compared with experimental values from a shock tube, both for circular and rectangular channels. A good agreement was obtained. Also the interaction of a shock wave with a channel of varying cross section is considered. So a new theory to calculate the changes in shock strength after a nozzle and a diffuser is described. There is the possibility to calculate reflected waves, as shock waves in front of a converging channel and a expansion wave in front of a diverging channel. Also the problem of the influence of dissipation to the change in shock strength is solved. The theory calculates the pressure drop of the 'shock-shock', which takes place in a diffuser, if the flow is accelerated to the velocity of sound from a strong expansion wave. The shock strength was measured for different area ratios and the results of the calculation were compared with experimental values from a shock tube. A good agreement was obtained. (orig.).

7184 (PSI–104) **Assessment of RELAP5/MOD2, Cycle 36.02, using NEPTUN reflooding experimental data: International code assessment programme.** Richner, M. (Paul Scherrer Inst. (PSI), Villigen (Switzerland)); Analytis, G.T.; Aksan, S.N. Paul Scherrer Inst. (PSI), Villigen (Switzerland). Oct 1991. 98p. (NUREG/IA–00103.). Order Number DE92613719. Source: OSTI; NTIS (US Sales Only); INIS.

Seven NEPTUN reflooding experiments with varying parameters flooding rate, single rod power, pressure and initial rod temperatures were simulated with the code RELAP5/MOD2, version 36.02, to assess the code, especially its reflood model. These calculations were performed with the specific objectives of evaluating the general prediction capability as well as specific problem areas of the RELAP5/Mod2 code in modelling boil-off and reflood behavior. First a study of the effect of the hydraulic and conduction nodalization to the results of the code was performed using a high and a low flooding rate experiment. After the choice of a proper nodalization, base calculations were done for all seven NEPTUN reflooding tests. The differences between code predictions and experiments are described and analysed. Implementing new correlations into the code and modifying or correcting existing correlations, for example for wall heat transfer or interphase friction, some of the weak points of the code during reflooding could be identified. These modifications were checked with all seven NEPTUN experiments. Additionally, two FLECHT-SEASET tests were simulated with the frozen version and also with the modifications mentioned above. (author) 60 figs., 4 tabs., 17 refs.

7185 (UCRL–53868-90, pp. 2.1-2.2) **TOPAZ2D quality assurance.** Shapiro, A.B. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

This year the authors began a software quality assurance program to validate the TOPAZ2D heat transfer code. Their objective is to develop an automatic test suite of benchmark problems that exercise different paths through the program to verify that the program's actual structure matches its intended structure. To date they have run and documented 20 problems.

7186 (UCRL–53868-90, pp. 2.28-2.30) **MONT3E and MONT3D Monte Carlo heat-transfer codes.** Maltby, J.D. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

The MONT3E and MONT3D codes calculate heat transfer due, respectively, to electron backscatter and to thermal radiation. Both codes calculate heat transfer in a similar manner and for the same simulated environment: a three-dimensional shaded enclosure without a participating medium. For MONT3E problems, the enclosed space includes a spatially variable magnetic field. Beginning FY 91, MONT3D capability will also include problems involving a participating medium. Current work involves modifying the codes to run on multiple RISC processors, which are well suited to the codes' characteristics. A new magnetic-field preprocessor and improved graphics for MONT3E are briefly discussed.

7187 (UCRL–53868-90, pp. 2.3-2.6) **Code acquisition and development project of the thermo-fluid mechanics group.** Stein, W. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

The Thermo-Fluid Mechanics Group identifies, acquires, and develops computer codes that solve fluid-flow and heat-transfer problems. Current work includes: modifying KIVA-11, a time-dependent code that uses finite-volume methods to model compressible flow and heat transfer in three dimensions, the modifications expand the code's ability to handle a greater variety of boundary conditions and geometrical shapes, thereby enabling the code to solve a wider range of problems; updating the SLIC mesh-generator user's manuals; developing an examples manual for the TOPAZ2D finite-element heat-transfer code; modifying the three-dimensional incompressible-flow and heat-transfer code, LMT, to include capabilities to solve turbulent-flow problems.

4205 Materials Testing

Refer also to citation(s) 6534, 6944, 6947, 6955, 6995, 7018, 7159, 7524

7188 (ANL/CP–73611) **Shaping particles for ultramicrotomy.** Bradley, C.R.; Dietz, N.L.; Bates, J.K. Argonne National Lab., IL (United States). [1991]. 6p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract W-31109-ENG-38. (CONF-911202–16: Annual fall meeting of the Materials Research Society, Boston, MA (United States), 2-6 Dec 1991). Order Number DE92005242. Source: OSTI; NTIS; GPO Dep.

A technique for preshaping large particles of reacted glass for ultramicrotomy is described. This technique preserves delicate surface layers and results in more sections per block extending deeper into the sample than other techniques.

7189 (ANL/CP–74775) **Residual and applied stress measurements at IPNS.** Richardson, J.W. Jr. Argonne National Lab., IL (United States). [1991]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-9103130–5: North Atlantic Treaty Organization (NATO) advanced research workshop on measurement of residual stress and applied stress using neutron diffraction, Oxford (United Kingdom), 18-22 Mar 1991). Order Number DE92004127. Source: OSTI; NTIS; GPO Dep.

The Intense Pulsed Neutron Source (IPNS) at Argonne National Laboratory has operated as a user facility since 1981. From the early days on, highly precise measurement of structural parameters including lattice constants has been a major objective of developments on the powder diffractometers at IPNS. The General Purpose Powder Diffractometer (GPPD) combines excellent instrumental resolution – roughly independent of d-spacing – with good neutron flux to provide an exceptional tool for the measurement of residual and applied stresses.

7190 (FhG-IWM-W–5/90) **A new approach to intensity and background corrections for roentgenographic residual stress measurement using the ω-diffractometer.** Pfeiffer, W. Fraunhofer-Institut fuer Werkstoffmechanik, Freiburg im Breisgau (Germany). Feb 1991. 46p. (In German). Order Number DE92758983. Source: OSTI; NTIS (US Sales Only); INIS.

This report deals with the correction of intensity distributions of diffraction lines and background radiation for roentgenographic residual stress determination. The x-ray physical fundamentals of various effects influencing both the measurable intensity distribution of diffraction lines and different proportions of background radiation are compiled and a new method of intensity and background correction is derived. The new approach is tested and verified using residual stress analyses of different material conditions with different levels of background radiation. The results show that the method provides quantitatively correct residual stress analyses even in cases where the previously common procedure for intensity and background correction fails. (orig./MM).

7191 (IAEA-TECDOC–628) **Training guidelines in non-destructive testing techniques. 1991 edition.** International Atomic Energy Agency, Vienna (Austria). Oct 1991. 274p. Order Number DE92615082. Source: OSTI; NTIS (US Sales Only); INIS.
Also issued in Spanish as IAEA-TECDOC-628/S.

Non-destructive testing methods (NDT), by their very nature, allow components to be fully examined for properties or flaws without interfering with their usefulness. This grouping of inspection methods has grown from a handful of primitive techniques practised by artists to a widely known discipline which is an essential part of quality control, largely as a result of the standards demanded by the nuclear and aerospace industries. Recognizing the need for an international publication of NDT training syllabi, the IAEA Consultants Meeting on "Qualification and Certification of NDT Personnel" (Milan, 20-21 May 1986), recommended that the Agency publish the guidelines developed by Regional Working Group of the Latin America and Caribbean project. It was first issued in English in 1987 and has now been re-edited in English and Spanish and enlarged by the addition of programmes for other techniques.

7192 (IAEA-TECDOC–628/S) **Training guidelines in non-destructive testing techniques.** International Atomic Energy Agency, Vienna (Austria). Oct 1991. 274p. (In Spanish). Order Number DE92615083. Source: OSTI; NTIS (US Sales Only); INIS.
Also issued in English as IAEA-TECDOC-628.

Non-destructive testing methods (NDT), by their very nature, allow components to be fully examined for properties or flaws without interfering with their usefulness. This grouping of inspection methods has grown from a handful of primitive techniques practised by artists to a widely known discipline which is an essential part of quality control, largely as a result of the standards demanded by the nuclear and aerospace industries. Recognizing the need for an international publication of NDT training syllabi, the IAEA Consultants Meeting on "Qualification and Certification of NDT Personnel" (Milan, 20-21 May 1986), recommended that the Agency publish the guidelines developed by Regional Working Group of the Latin America and Caribbean project. It was first issued in English in 1987 and has now been re-edited in English and Spanish and enlarged by the addition of programmes for other techniques.

7193 (INIS-BR–2887) **Radiography with neutrons: use in inspection of hydrogenated materials.** Pugliesi, R. (Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, SP (Brazil)); Assuncao, M.P.M. Fundacao de Tecnologia Industrial (FTI), Lorena, SP (Brazil). 1989 9p. (In Portuguese). (CONF-8911255–: 3. workshop on combustion and propulsion, Lorena (Brazil), 28-30 Nov 1989). Order Number DE92615084. Source: OSTI; NTIS (US Sales Only); INIS.

Neutron radiography technique is used for showing the viability of inspecting hydrogenated materials. The experimental disposition is installed in irradiation radial channel n. 10 from IEA-R1 (IPEN-CNEN-SP). The inspetionated materials were munitions for gun and rifle. (C.G.C.).

7194 (KAERI/RR–968/90) **Analysis of the irradiation creep and growth of KMRR structural materials of zircaloy-4.** Rheem, Karp Soon (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Kim, Seon Jin; Han, Jung Ho; Jeong, Young Hwan; Lee, Deuk Hyun; Park, Gi Sung. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Feb 1991. 63p. (In Korean). Order Number DE92615086. Source: OSTI; NTIS (US Sales Only); INIS.

With relation to the dimensional stability and mechanical integrity of the KMRR core Zircaloy-4 structures during long-term irradiation, in-pile creep/growth behaviors of Zircaloy-4 were investigated by means of stress relaxation tests under neutron irradiation in TRIGA MK-III reactor to secure optimum conditions for the fabrication of of Zircaloy structure for dimensional stability. Since the Zircaloy core structure would be β-treated to maximize dimensional stability, the optimum condition for increasing the toughness as well as strength of β-treated Zircaloy was also investigated. The cooling rate of 5 deg C/sec to 110 deg C/sec was found to show the maximum toughness and strengh. In the in-pile stress relaxation tests under the fast neutron flux of 1.2×10^{17} n/m^{2}sec at 373 deg K in core of the TRIGA Mark-III reactor, the 50 μm thick foils of α/β heat treated Zircaloy-4 specimens showed that creep strain of α-annealed specimens is slightly higher than that of β-annealed specimens. From the result, plate matrix and its welded parts of Zircaloy-4 structures would be negligible when the Zircaloy core materials are properly β-heat treated. Low cycle fatigue life and strength were measured for the α/β heat treated and proton beam irradiated specimens. The fatigue life of β-annealed specimens reduced to 1/5 of that of the α-annealed. Reduction in fatigue life of β-annealed specimens was attributed to the annihilation of textured structures during the cycling of Zircaloy specimens. The effect of proton beam irradiation on the low cycle fatigue life was negligible at room temperature. (Author).

7195 (STU-I–773-1990) **Control of the development of residual stresses and heat affected zone (HAZ) microstructure during welding of low alloy steels and influence on stress relieve cracking.** Storesund, J. (Swedish Inst. for Metals Research, Stockholm (Sweden)); Rui Wu; Sandstroem, R.; von Walden, E. Swedish National Board for Technical Development, Stockholm (Sweden). 1990. 178p. (IM–2619;IM–2705;IM–2706.). Order Number DE92613770. Source: OSTI; NTIS (US Sales Only); INIS.

Creep resistant 1 Cr 0.5 Mo steels are frequently used as steam pipes at operating temperature of 450 degree C to 500 degrees C. Welded joints have been post weld heat treated (PWHT). The results show: - In fully refined microstructures close to the fusion boundary of the weldments a reduction of the grain size by a factor of 3-4 was measured. The impact transition temperature was up to 27 degree C lower for test series notched in the refined HAZ (Heat Affected Zone) than in the coarse grained HAZ of the as welded condition. The overlay heat treatments were not observed to significantly influence the hardness and the room temperature tensile properties of the weldments. - The influence of refinement on impact transition temperature (ITT) and upper shelf energy was beneficial. In the coarse grained HAZ, for which the ITT was significantly higher than for weld metal and base metal, the refinement resulted in a 30 degrees C lower value of the ITT. The influence of PWHT on impact properties was also studied. The PWHT raised the upper shelf energy greatly. The effect on the ITT was smaller than that of refinement. - For cross welds in the as-welded (AW) condition refinement improved the creep properties. After PWHT the creep ductility was significantly increased at the same as a considerable reduction of life was observed. At lower stresses the effects of refinement and especially PWHT were less pronounced. Beneficial influence of refinement in inhibiting the formation of creep cavitation was apparent regardless stress level in both AW and PWHT conditions. (K.A.E).

7196 (STU-I–774-1990) **Crack initiation and propagation in welded joints of turbine and boiler steels during low cycle fatigue.** Lindblom, J. (Swedish Inst. for Metals Research, Stockholm (Sweden)); Sandstroem, R.; Linde, L.; Henderson, P. Swedish National Board for Technical Development, Stockholm (Sweden). 1990. 122p. (IM–2646;IM–2699.). Order Number DE92613771. Source: OSTI; NTIS (US Sales Only); INIS.

Low cycle fatigue (LCF) tests have been performed at 300 and 565 degrees C on welded joints and on microstructures to be found in or near welded joints in a low alloy ferritic steel 0.5 Cr, 0.5 Mo, 0.25 V. The difference in lifetimes between the 300 degrees C and 565 degrees C tests was small comparing the same microstructures and strain ranges, although the stress amplitude was greater at 300 degrees C. Under constant stress conditions the fatigue life depended on the fatigue life of the parent metal but under constant strain conditions the lifetime was governed by that of the bainitic structures. Strain controlled LCF tests have been performed at 750 degrees C on welded joints in the austenitic steel AISI 316 and on different parent and weld metals used in these joints. In continuously cycled samples all cracks were transgranular and initiated at the surface; hold-time samples displayed internally initiated intergranular cracking in the weld metal. Under constant strain conditions the 316 parent and weld metals exhibited similar lifetimes. When considering a constant stress situation the strength of the microsturctures decreased in the following order: Sanicro weld metal, cold deformed parent metal, undeformed parent metal and weld metal (K.A.E.).

7197 (UCRL–53868-90, pp. 7.1-7.3) **Laser generation and detection of ultrasonic energy.** Thomas, G.H.; Lewis, D.K.; Wagner, J.W. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

In nondestructive evaluation (NDE) of a specimen using ultrasonic acoustic energy, an ultrasonic generator directs the energy into the object while a detector, or detectors, on the exterior of the object records the emerging energy, thus providing data from which anomalous conditions such as voids or cracks inside the object can be deduced. Traditional ultrasonic NDE methods require a fluid acoustic couplant between the object being examined and the generator and detector of the ultrasonic energy. This need for acoustic coupling prohibits applying traditional methods when contamination of the object is possible or when the object is in a hostile environment often present in processing operations. The authors are studying the ability of lasers to generate and detect ultrasonic acoustic energy in objects at a distance, with the idea of developing a new technique of ultrasonic NDE that could be carried out without touching the object being examined and hence would widen the applicability of the method.

7198 (UCRL–53868-90, pp. 7.14-7.41) **Computerized tomography.** Martz, H.E.; Perkins, D.E.; Schneberk, D.J.; Azevedo, S.G.; Skeate, M.F.; Roberson, G.P. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

The authors are developing several data-acquisition scanners for computerized tomography (CT) along with associated computational techniques for image reconstruction, analysis, and display. They report here on recent progress in scanner development, reconstruction algorithm research, and applications work. They have sought to advance the state of the art in CT technology while at the same time actively supporting programs. Their goal is to provide reliable and efficient nondestructive evaluation techniques to use in probing the internal structure of fabricated objects and materials associated with a broad spectrum of Laboratory-wide programs.

7199 (UCRL–53868-90, pp. 7.4-7.5) **Quantitative radiography by image digitization without film.** Dolan, K.W.; Ryon, R.W. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

Digital x-ray images are traditionally obtained from a multiple step process involving film exposure, film processing, and film digitization. Nonlinearities introduced at each stage of this process make it difficult to obtain accurate, quantitative information from digitized radiographs. There are at least two methods to eliminate nonlinearities in image digitization. One method makes use of photostimulable phosphor storage plates. The phosphor plates store x-ray exposure images through the process of electronic transitions into trapped lattice sites forming metastable color centers. The plates are read out using a scanning laser beam to stimulate light emission and a photomultiplier tube to measure light output. This technology is gaining acceptance in medical radiology where decreased dosages and higher contrast relative to film have been demonstrated. A second method uses linear diode arrays in which the image is digitized directly from the response of the diode elements. Both of these methods offer high throughput capability, wide dynamic range, and spatial resolution comparable to the faster film digitizing systems, e.g. 5 line pairs per mm. Although neither method offers the spatial resolution inherent in a film image, which can be better than 100 line pairs per mm, the potential for obtaining quantitative information from the digitized images at high throughput rates provides distinct advantages over traditional film radiography.

7200 (UCRL–53868-90, pp. 7.6-7.8) **X-ray optics for microimaging and other applications.** Ryon, R.W. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

The authors are developing x-ray optics primarily so that they can perform scanning x-ray microscopy utilizing fluorescence and other interactions. By this means, they can produce high-resolution images of material characteristics such as chemical composition, electron density, or bulk density. The principal technique they have been employing is known as Kirkpatrick-Baez mirror optics. In this technique, the mirrors effectively increase the efficiency of the system by gathering and focusing the x-ray photons produced by a conventional x-ray source. Most x-ray microscopy to date has been done with soft x rays (<1 keV); they, however, started at 8 keV and are ready to extend the capability to 20 keV. They have also designed a similar system to produce a parallel beam of x rays for long-distance alignment applications. Most of the components for this parallel-beam system are built and ready for testing.

4260 Components, Electron Devices and Circuits

Refer also to citation(s) 6528, 6753, 6762, 6949, 6989, 7056, 7259, 7262, 7267, 7296, 7360, 7371, 7475, 7476, 7485, 7486, 7491, 7492, 7503, 7509

7201 (ENEA-RT-INN–90-17) **Compact kinetic code for discharge pumped XeCl laser modelling.** Letardi, T.; Fu, S.; Fang, H. ENEA, Frascati (Italy). Dipt. Sviluppo Tecnologie di Punta. Jun 1991. 11p. (CONF-900368–12: International congress on optical science and engineering, The Hague (Netherlands), 12-16 Mar 1990; RT/INN–90-17). Order Number DE92744021. Source: OSTI; NTIS (US Sales Only).

From International congress on optical science and engineering SPIE 1990; The Hague, Netherlands (12-15 Mar 1990).

A compact kinetic code for the theoretical modelling of discharge pumped XeCl lasers was developed and used to model the performance and discharge characteristics of x-ray pre-ionized lasers. The results are in good agreement with the experiments. This paper discusses in detail the effects of superelastic and electron-electron collisions which are neglected in the compact code on the modelled results.

7202 (ENEA-RT-INN–90-36) **Observation of coherent mm wave radiation from microtron driven Cherenkov FEL.** Ciocci, F.; Doria, A.; Gallerano, G.P.; Giabbai, I.; Kimmitt, M.F.; Messina, G.; Renieri, A.; Walsh, J.E. ENEA, Frascati (Italy). Dipt. Sviluppo Tecnologie di Punta; Essex Univ., Colchester (United Kingdom); Dartmouth Coll., Hanover, NH (United States). Dept. of Physics and Astronomy. Jun 1991. 12p. (CONF-901293–2: International conference on lasers '90, San Diego, CA (United States), 3-7 Dec 1990; RT/INN–90-39). Order Number DE92744007. Source: OSTI; NTIS (US Sales Only).

From International conference on lasers '90; San Diego, CA, USA (10-14 Dec 1990).

Low energy radio frequency (r.f.) electron beam (e-beam) sources have a potential application as drivers for FELs (free electron lasers) operating in the far-infrared and sub-millimeter (sub-mm) region since they can provide short pulses of coherent radiation in a spectral region not covered by conventional laser sources. A 5 MeV microtron capable of delivering 20 ps bunches with a 4A peak current was utilized at the ENEA (Italian Commission for Nuclear and Alternative Energy Sources) sub-mm FEL facility to drive a Cherenkov free electron laser designed to operate in the spectral region from 100 microns to 2 mm. In this type of device, a beam of relativistic electrons excites TM-like surface waves in a dielectric loaded waveguide when their velocity is close to the phase velocity of the wave in the guide. The longitudinal component of the evanescent electric field causes a bunching of the electrons giving rise to stimulated emission. This paper reports the observation of coherent emission in the microtron driven Cherenkov FEL when power up to 50 W in 4 micron pulses was generated at the wavelengths of 1.6 mm and 0.9 mm by using two different dielectric loaded waveguides. Tunning results obtained by varying the waveguide gap are also reported.

7203 (ENEA-RT-INN–90-38) **Towards generalized version of Madey's theorem.** Dattoli, G.; Giannessi, L.; Mezi, L.; Torre, A. ENEA, Frascati (Italy). Dipt. Sviluppo Tecnologie di Punta. Jun 1991. 13p. (RT/INN–90-38). Order Number DE92744019. Source: OSTI; NTIS (US Sales Only).

The paper shows that longitudinal and transverse mode correction to the FEL (free electron laser) low gain formula can be expressed by means of higher order derivatives of the complex spontaneous emission function. The analysis is then extended to the high gain regime.

7204 (ENEA-RT-INN–90-51) **Intensity saturation mechanism in free electron lasers.** Dattoli, G.; Giannessi, L.; Cabrini, S. ENEA, Frascati (Italy). Dipt. Sviluppo Tecnologie di Punta. Jun 1991. 11p. (RT/INN–90-51). Order Number DE92743980. Source: OSTI; NTIS (US Sales Only).

The gain saturation mechanism of a free electron laser (FEL) is different from that of a conventional laser. Furthermore, the interaction itself causes an energy loss of the electron beam and induces an energy spread, thus determining the saturation of the system itself. Albeit apparently different, the FEL gain saturation mechanism is reproduced by an equation analogous to that exploited for conventional lasers. This paper proves that the FEL exhibits a scaling of the gain saturation versus intensity which is analogous to that of conventional lasers; introduces the concept of FEL intensity of saturation and finds its expression in terms of the system parameters; and finds a simple relationship between FEL output intensity and saturation intensity.

7205 (ENEA-RT-INN–90-55) **Study of self-preionized XeCl electron-avalanched discharges.** Letardi, T.; Bollanti, S.; Di Lazzaro, P.; Flora, F.; Zheng, C.E. ENEA, Frascati (Italy). Dipt. Sviluppo Tecnologie di Punta. Apr 1991. 24p. (RT/INN–90-55). Order Number DE92743978. Source: OSTI; NTIS (US Sales Only).

Preionization of laser gases has proved to be an effective means of initiating a homogeneous discharge at gas pressures higher than one atmosphere, and some papers have been published on preionization requirements for obtaining a homogeneous discharge. Several experimental approaches have been carried out regarding the development of preionization sources. One of the simplest is to use a pin array on the cathode surface to produce a corona discharge which emits photoionizing radiation. By applying a fairly slow-rising discharge voltage with a rise time of about 1 microsec (from 10% to 90%) to this kind of electrode, over 1 J of XeCl laser output energy per pulse, with a pulse duration of about 120 ns (FWHM) and a spot size of 2x7 square centimeters in the near field, was obtained. The device is attractive in its simplicity, as it has neither an additional preionization circuit nor a low-inductance switch between the discharge chamber and pulse-forming line, although the laser efficiency may be rather low. In this paper, based on previous works, the conditions necessary for the formation of a spatially diffuse discharge in this kind of electrode configuration are analyzed, and some characteristics of the discharge at the streamer-formation stage are calculated and compared with the experimental observations.

7206 (ENEA-RT-INN–90-57) **Simple model of gain saturation in free electron lasers.** Dattoli, G.; Giannessi, L.; Cabrini, S. ENEA, Frascati (Italy). Dipt. Sviluppo Tecnologie di Punta. Jun 1991. 9p. (RT/INN–90-57). Order Number DE92744014. Source: OSTI; NTIS (US Sales Only).

This paper analyzes the dynamics of a free electron laser (FEL) in the strong signal regime. A parallel is drawn with the dynamics of a conventional laser. A simple model of gain saturation is developed, and a scaling relation of gain versus the intra-cavity laser intensity is derived.

7207 (ENEA-RT-INN–90-58) **Discharge dynamics study of self-sustained XeCl lasers.** Letardi, T.; Fang, H.Y.; Fu, S. ENEA, Frascati (Italy). Dipt. Sviluppo Tecnologie di Punta. Jun 1991. 14p. (RT/INN–90-58). Order Number DE92744010. Source: OSTI; NTIS (US Sales Only).

Discharge dynamics is crucial for self-sustained discharge pumped XeCl lasers. The stability of the discharge not only limits the energy deposition and laser pulse duration, but also plays a very important role in the laser output beam quality, e.g., intensity spatial distribution, beam divergence, etc. Many efforts have been made, both theoretically and experimentally, to improve discharge stability, and numerous papers devoted to this subject have been published. This paper presents some results of discharge dynamics studies on self-sustained XeCl lasers. The investigations were performed using a kinetic code that included the Boltzmann equation, species density rate equations, and circuit equations. The discharge process was divided into four stages: the initial stage, from spark gap switch-on to the static breakdown field; avalanche build-up stage, from the point at which the gas mixture resistance starts to decrease, to the quasi-steady-state discharge occurrence; quasi-steady-state stage, during which the resistance of the gas mixture and the voltage on the discharge gap are nearly constant; terminal stage, when the lasing stops.

7208 (ENEA-RT-INN–90-59) **Free electron lasers: Contributions to 12th international conference.** ENEA, Frascati (Italy). Dipt. Sviluppo Tecnologie di Punta. Apr 1991. 39p. (CONF-9009166–Exc.: 12. international free electron laser conference (FEL-12), Paris (France), 17-21 Sep 1990; RT/INN–90-59). Order Number DE92744002. Source: OSTI; NTIS (US Sales Only).

From 12. International free electron laser conference; Paris, France (17-21 Sep 1990).

Separate abstracts were prepared for three contributions to the 12th International Conference on Free Electron Lasers (FELs). The papers included the following: a discussion, in the small signal small gain approximation both in the homogeneous and inhomogeneous broadening regimes, of the dispersion properties of a guiding structure giving rise to new kinematic and dynamic properties of a free electron laser waveguide; the observation of coherent emission from a Cherenkov FEL driven by a 5 MeV radio frequency microtron; a review of the FEL wave equation accounting for longitudinal or/and transverse mode dynamics in the small signal regime within the context of a general operator approach to non-local integro-differential equations.

7209 (ENEA-RT-INN–90-66) **Extraction efficiency of laser active medium: Optimization.** Flora, F.; Hermsen, T. ENEA, Frascati (Italy). Dipt. Sviluppo Tecnologie di Punta. Jun 1991. 22p. (RT/INN–90-66). Order Number DE92744024. Source: OSTI; NTIS (US Sales Only).

In the design of high power laser sources, the choice of the active medium geometry is of fundamental importance for the optimization of energy extraction capability. This paper compares, by means of simple analytical deductions and numerical simulations, the energy extraction efficiency of different optical configurations ranging from simple resonators such as the plano-plano, the confocal positive branch, or the self-filtering unstable (SFUR) up to more complex systems like multi-pass amplifiers or combined oscillator-amplifiers (MOPA).

7210 (ENEA-RT-INN–90-71) **MOPA FEL Stanford experiment: Simple analysis.** Dattoli, G.; Giannessi, L.; Torre, A.; Fang, H. ENEA, Frascati (Italy). Dipt. Sviluppo Tecnologie di Punta. May 1991. 12p. (RT/INN–90-71). Order Number DE92744005. Source: OSTI; NTIS (US Sales Only).

This paper analyzes the results of the FEL (free electron laser) MOPA (master oscillator power amplifier) experiment recently performed at Stanford. A one dimensional model is used and the observed violation of the Madey's theorem is quantitatively reproduced. This note, albeit based on a one dimensional analysis, supports the hypothesis that the observed deviations from Madey's theorem may be essentially due to high gain effects. However, since the inhomogeneous broadening effects strongly suppress the high gain contributions, it can also be argued that most of the observed phenomena are due to the interplay between the high gain dynamics and the modifications induced by the beam energy spread.

7211 (LAMP–91/2) **Development of tunable flashlamp excited dye laser system.** LAMP series report (Laser, Atomic and Molecular Physics). Bhanthumnavin, V. (International Centre for Theoretical Physics, Trieste (Italy)); Apikitmata, S.; Kochareon, P. International Centre for Theoretical Physics, Trieste (Italy). May 1991. 9p. Order Number DE92611160. Source: OSTI; NTIS (US Sales Only); INIS.

A tunable flashlamp excited dye laser (FEDL) was successfully developed for the first time in Thailand by Thai scientists at KMIT Thonburi (Bangmod). The Rhodamine 6G dissolved in ethyl alcohol was utilized as a laser medium and circulated by a pump through a laser head. The dye cuvette had an inner diameter of 4.0 mm and was 90 mm long. The cavity mirrors M_1, and M_2 were concave mirrors with reflectivities of 100% and 73% respectively. A power supply of 0-20 kV and current of 0-50 mA charged a capacitor of 0.3 μ f at 10-15 kV which was then discharged via a spark gap through the flashlamp. The output laser wavelengths was tunable from λ = 550-640 nm. It is the first FEDL system, locally developed, which has a tunable wavelength for the laser output. The laser pulse width is about 1.0 μs with energy of 20 mJ and peak power pf 20 KW. The repetition rate of the laser is 1/15 Hz. (author). 14 refs, 7 figs.

7212 (LA-UR-91-3526) **Measuring neutron fluences and gamma/x-ray fluxes with CCD cameras.** Yates, G.J. (Los Alamos National Lab., NM (United States)); Smith, G.W.; Zagarino, P.; Thomas, M.C. Los Alamos National Lab., NM (United States). [1991]. 13p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-911106–29: IEEE nuclear science symposium, Santa Fe, NM (United States), 5-9 Nov 1991). Order Number DE92003863. Source: OSTI; NTIS; INIS; GPO Dep.

The capability to measure bursts of neutron fluences and gamma/x-ray fluxes directly with charge coupled device (CCD) cameras while being able to distinguish between the video signals produced by these two types of radiation, even when they occur simultaneously, has been demonstrated. Volume and area measurements of transient radiation-induced pixel charge in English Electric Valve (EEV) Frame Transfer (FT) charge coupled devices (CCDs) from irradiation with pulsed neutrons (14 MeV) and Bremsstrahlung photons (4–12 MeV endpoint) are utilized to calibrate the devices as radiometric imaging sensors capable of distinguishing between the two types of ionizing radiation. Measurements indicate $\approx$.05 V/rad responsivity with $\geq$1 rad required for saturation from photon irradiation. Neutron-generated localized charge centers or "peaks" binned by area and amplitude as functions of fluence in the 10^5 to 10^7 n/cm^2 range indicate smearing over $\approx$1 to 10% of CCD array with charge per pixel ranging between noise and saturation levels.

7213 High voltage bipolar-CMOS structure using porous silicon. Guilinger, T.R.; Kelly, M.J.; Tsao, S.S. To Dept. of Energy. 1990. Filed date 8 May 1990. USA Patent patent application 7-520,475. 20p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE92004613. Source: OSTI; NTIS; GPO Dep.

A method for integrating a silicon-on-insulator device and a bulk bipolar device on a semiconductor body. The invention simultaneously forms the two regions for the silicon-on-insulator device and the bipolar device. The invention enables a high voltage CMOS power device to be located on the same chip as a bipolar logic device enabling smart power devices.

7214 Rectifier cabinet static breaker. Costantino, R.A.; Gliebe, R.J. To Dept. of Energy. 1990. Filed date 30 May 1990. USA Patent patent application 7-530,513. 27p. Sponsored by National Aeronautics and Space Administration. Contract N00024-79-C-4026. Order Number DE92004620. Source: OSTI; NTIS; GPO Dep.

A rectifier cabinet static breaker replaces a blocking diode pair with an SCR and the installation of a power transistor in parallel with the latch contactor to commutate the SCR to the off state. The SCR serves as a static breaker with fast turnoff capability providing an alternative way of achieving reactor scram in addition to performing the function of the replaced blocking diodes. The control circuitry for the rectifier cabinet static breaker includes on-line test capability and an LED indicator light to denote successful test completion. Current limit circuitry provides high-speed protection in the event of overload.

7215 Electrical grounding prong socket. Leong, R. To Dept. of Energy. 1990. Filed date 31 May 1990. USA Patent patent application 7-531,437. 29p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE92003740. Source: OSTI; NTIS; GPO Dep.

The invention is a socket for a grounding prong used in a three prong electrical plug and a receptacle for the three prong plug. The socket being sufficiently spacious to prevent the socket from significantly stretching when a larger, U-shaped grounding prong is inserted into the socket, and having a ridge to allow a snug fit when a smaller tubular shape grounding prong is inserted into the socket. 17 figs.

7216 Apparatus and process for active pulse intensity control of laser beam. Wilcox, R.B. To Dept. of Energy. 1990. Filed date 19 Jun 1990. USA Patent patent application 7-540,237. 17p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE92003810. Source: OSTI; NTIS; GPO Dep.

An optically controlled laser pulse energy control apparatus and process is disclosed wherein variations in the energy of a portion of the laser beam are used to vary the resistance of a photodetector such as a photoresistor through which a control voltage is fed to a light intensity controlling device through which a second portion of the laser beam passes. Light attenuation means are provided to vary the intensity of the laser light used to control the resistance of the photodetector. An optical delay path is provided through which the second portion of the beam travels before reaching the light intensity controlling device. The control voltage is supplied by a variable power supply. The apparatus may be tuned to properly attenuate the laser beam passing through the intensity controlling device by adjusting the power supply, the optical delay path, or the light attenuating means. 3 figs.

7217 Counterrotating brushless dc permanent magnet motor. Hawsey, R.A.; Bailey, J.M. To Dept. of Energy. 1990. Filed date 30 Jul 1990. USA Patent patent application 7-559,030. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE92003825. Source: OSTI; NTIS; GPO Dep.

An brushless DC permanent magnet motor is provided for driving an autonomous underwater vehicle. In one embodiment, the motor comprises four substantially flat stators disposed in stacked relationship, with pairs of the stators being axially spaced and each of the stators comprising a tape-wound stator coil; and a first and second substantially flat rotors disposed between the spaced pairs of stators. Each of the rotors includes an annular array of permanent magnets embedded therein. A first shaft is connected to the first rotor and a second, concentric shaft is connected to the second rotor, and drive unit causes rotation of the two shafts in opposite directions. The second shaft comprises a hollow tube having a central bore therein in which the first shaft is disposed. Two different sets of bearings support the first and second shAfts. In another embodiment, the motor comprises two ironless stators and pairs and rotors mounted no opposite sides of the stators and driven by counterrotating shafts.

7218 (SAND-91-1367C) **The use of modal analysis in the development of advanced lithography machines.** Roach, D.P. Sandia National Labs., Albuquerque, NM (United States). [1991]. 19p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-920234–2: 10. international modal analysis conference (IMAC), San Diego, CA (United States), 3-6 Feb 1992). Order Number DE92004742. Source: OSTI; NTIS; GPO Dep.

The use of modal analysis as a diagnostic tool is rapidly increasing. This paper describes a unique application of this technology in the analysis of an advanced lithography machine. This machine, a "step-and-repeat" system, uses a photographic process to print electronic circuit patterns on wafers with resolutions on the order of nanometers. Consequently, it is imperative for the structural response to be controlled during the machine's normal operations. Modal, vibration, and timing control experiments were conducted in order to assess the various design features which provide optimum machine performance. It was determined that the vibration sources and the stiffness of the machine components are tailored to complement each other such that all potential problem areas are avoided. In addition, special design features are employed to allow the machine to quickly optimize conditions – such as wafer residual motion and positioning error – prior to wafer exposure. The ultimate goal of this investigation is to provide guidelines to improve the accuracy and reliability of lithography equipment and to aid in the development of more advanced machines. 7 refs., 10 figs.

7219 (UCRL–53868-90, pp. 1.14-1.18) **Modeling pulse-driven antennas.** McLeod, R.R.; Pennock, S.T.; Barth, M.J. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

The authors describe an accurate and versatile back-projection technique that predicts field values for pulse-driven microwave antenna systems anywhere in space, given experimental data from only one or a few points. Their approach first models the near-field environment of the antenna system with a standard finite difference time domain electromagnetic modeling code, and then transforms the resultant near-field information to the far field. This technique is valuable in a number of Laboratory programs. For example, intelligence measurements of antenna radiation, combined with knowledge of the antenna itself, can be used as a means of identifying the source.

7220 (UCRL–53868-90, pp. 1.24-1.27) **Localized wave transmission.** Lewis, D.K. (Lawrence Livermore National Lab., CA (United States)); Ziolkowski, R.W. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

The authors are investigating localized wave (LW) transmission, in which the wave energy theoretically does not spread or diminish in amplitude even when propagated over extreme distances. They are using computer modeling and experiments to study the launching and propagation characteristics of LW fields and to investigate potential wave-launching systems. Their current LW experiments to substantiate theory are being performed in an acoustic environment with a launching system consisting of a 25-element array driven by six individually tailored drive signals, at an effective ultrasonic frequency of 320 kHz. Using this same array, they compared the LW results with conventional monochromatic (continuous-wave) tone bursts at 500 kHz. They have achieved the LW effect well beyond 10 Rayleigh distances.

7221 (UCRL–53868-90, pp. 1.28-1.34) **Modeling strained-layer semiconductor superlattices at Lawrence Livermore National Laboratory.** Mailhiot, C.; Khanaka, G.H.; White, W.T. III; Yee, J.H. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

Lawrence Livermore National Laboratory grows superlattice materials for a variety of photonic and electronic devices, including diode lasers and fast, sensitive detectors. To help design, test, and evaluate these novel materials, the authors have recently implemented a boundary-condition method for modeling superlattices, based on $k \cdot p$ techniques. The method is well suited for strained-layer superlattices, and it provides good accuracy in computing energy-band structure near the band edge. By using a large number of zone-center basis functions, they have extended the domain of validity to the entire Brillouin zone. They have applied the new superlattice codes to a variety of problems at LLNL, including infrared photodetectors, electroabsorption optical modulators, and electron transport.

7222 (UCRL–53868-90, pp. 1.6-1.13) **Quantum-well laser modeling.** Wahlstrand, K.J.; Yee, J.H.; Mariella, R.P. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

In recent quantum-well laser modeling, the authors computed the threshold current density as a function of laser-cavity length and compared the resultant values with experiments to validate their calculations. They also obtained new results, including gain with k-selection for several GRIN-SCH potentials of differing shapes; pulse compression in photon density vs energy in the steady-state, rate-equation solutions; and relaxation oscillations observed in transient rate-equation solutions, using gain with k-selection. They observed that multiple-quantum-well potentials show a narrower gain spectrum than single-quantum-well potentials, and that oscillation frequency is linear in the square root of the power, in agreement with experiments.

7223 (UCRL–53868-90, pp. 2.15-2.22) **Microchannel cooling optimization model.** Landram, C.S. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

Electronic circuits are often cooled by pumping a fluid through a microscopic array of thermally conducting fins. Modeling the optimum configuration for such a device is a surprisingly complex problem. A numerical model is presented for calculating an optimal microchannel geometry that will minimize semiconductor operating temperatures.

7224 (UCRL–53868-90, pp. 3.1-3.5) **Gallium arsenide CCDs for high-speed transient recording.** Cooper, G.A.; Davidson, J.C.; Swierkowski, S.P. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

The goal of this project is to design and fabricate gallium arsenide charge-coupled devices (CCDs) for imaging and transient-recording applications where sampling rates of 1 to 2 GHz are required. The authors have added a resistive gate process that has improved the charge transfer efficiency (CTE) of their devices, and they have established a modeling capability to explore design changes that could improve their performance.

7225 (UCRL–53868-90, pp. 3.10-3.12) **Microresonator laser array research.** McConaghy, C.F.; Mariella, R.P. Jr. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

Microresonator lasers with cavity lengths of 1.6 μm and mirror reflectivities over 99% were fabricated in GaAs by molecular beam epitaxy (MBE). Optical reflectivity data showed clear Fabry-Perot resonances, and the microresonator lasers lased single mode at wavelength near 850 nm when optically pumped by a dye laser at a wavelength of 796 nm. Streak camera measurements of the microresonators showed response times near 12 ps.

7226 (UCRL–53868-90, pp. 3.13-3.16) **Ion-assisted etching and deposition for microelectronics and microoptics.** Miller, D.E.; Folta, J.A. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

This is the second year of a proposed three-year research and technology development effort to enhance the materials-processing capabilities for microfabrication of advanced ultra-high-speed electronics and optical microstructures. Ion-assisted etching technically includes the more familiar methods of reactive-ion etching and plasma etching. In both of these dry etching techniques, the substrate being etched to form microstructues is immersed in a plasma. The principal focus of their project has been on ion-beam etching (IBE), or ion milling. With IBE, an ion-generating plasma is excited in a chamber separate from the main vacuum chamber that contains the substrate. This IBE arrangement allows dramatic variations in substrate-angle-ndependent etching and separate control of the relative values of the chemical and physical mechanisms that constitute the etching process.

7227 (UCRL–53868-90, pp. 3.21-3.24) **Infrared-sensitivie photocathodes.** Mariella, R.P. Jr. (Lawrence Livermore National Lab., CA (United States)); Cooper, G.A.; Behrendt, W.; Liliental-Weber, Z. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

Photocathodes that can respond to infrared light with useful sensitivities are not available commercially. The long-term objective of their project, started in FY 91, was to make such photocathodes. In preparation for growing IR-active photocathodes this year, they used their molecular beam epitaxy machine (MBE) to grow

$In_yGa_{1-y}As/GaAs$ strained-layer superlattices (SLS) on GaAs substrates in p-i-n structures. The $In_yGa_{1-y}As$ crystal structure has a slightly larger lattice constant than that of pure GaAs, but the layers are thin enough so that the $In_yGa_{1-y}As$ undergoes a coherent strain to match the lattice of the rest of the crystal, hence the term strained layer. The p-i-n devices that they have fabricated have allowed them to determine the absorption characteristics of their superlattices and to estimate their overall quantum efficiencies. This is a critical first step for a photocathode device. For the best superlattice this efficiency is 10% for 1.06 μm light.

7228 (UCRL–53868-90, pp. 3.6-3.9) **High-efficiency semiconductor lasers with custom wavelengths.** Mariella, R.P. Jr. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

In FY 90 the author used his molecular beam epitaxy (MBE) machine under full computer control to grow twenty wafers with graded-index separate-confinement-heterostructure (GRINSCH) strained-layer $In_yGa_{1-y}As$ single-quantum-well diode-laser structures. He processed these wafers into broad area lasers and each wafer produced functioning lasers. He observed threshold current densities, J_{th}, as low as 179 A/cm^2 for 0.35-mm long devices. Only one publication in the literature has reported a lower J_{th} for 0.35-mm long lasers.

7229 (UCRL–53868-90, pp. 6.1-6.6) **Magnetic switch modeling.** Zentler, J.M. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

The authors have developed a model that accurately simulates the behavior of magnetic switches. The model has been integrated into the NET-2 circuit analysis code to allow simulation of a wide variety of magnetic switching circuits. Specific versions of the model have been developed for 2605CO Metglas tape and TDK PE11B ferrite, two commonly used magnetic-core materials at the Laboratory. They have validated the switch model against experiment, and it is presently being applied in designing advanced accelerators in the Beam Research Program.

7230 (UCRL–53868-90, pp. 6.16-6.23) **Ultra-wideband microwave generation using GaAs photoconductive switches.** Hofer, W.W.; Druce, R.L.; Griffin, K.L.; Pocha, M.D. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

The authors developed a 4-6-MW, laser-triggered, GaAs-switched ultra-wideband microwave generator that produced a broad output-power spectrum of 0.5 to 2.0 GHz. Their design is a parallel-plate, mismatched, 1 ns pulsewidth Blumlein generator switched in 150 ps and integrated with a wideband microwave antenna. When they stacked two mismatched Blumlein generators in series, they found that their microwave outputs added in both phase and amplitude, clearly demonstrating the precise timing and low jitter achieved with laser-triggered photoconductive switching. Stacked arrays of Blumlein generators may be capable of producing output power in the multigigawatt range. Their experimental results agreed well with models of circuits and three-dimensional electromagnetic fields of the microwave generator.

7231 (UCRL–53868-90, pp. 6.7-6.15) **High-power microwave generation using a backward-wave oscillator.** Camacho, J.F.; Rosenbury, E.T.; Poole, B.R. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

The authors are investigating the high-power microwave (HPM) generation capability of a backward-wave oscillator (BWO) driven by an intense relativistic electron beam. In FY 90, they began an experimental and modeling effort with two objectives: to establish a BWO research program at LLNL by conducting an experiment based on a Soviet-like BWO design and to develop a source capable of efficiently generating a high-energy pulse ($\sim$ kJ) in the cm-wave regime. Their ultimate goal is to identify and study the mechanisms that prematurely terminate the microwave emission from BWOs operating at high power ($\sim$ 1 GW). They have made substantial progress in developing their BWO modeling capabilities, and have conducted linear theory analysis and nonlinear physics studies of BWO operation. Their experimental results show that their device operated at predominantly a single frequency, as expected, near the predicted operating point. Still, their BWO did not operate as efficiently as anticipated. In the future, they plan to continue their efforts to identify those effects that may be limiting BWO performance, to optimize that performance through hardware changes, and to develop more advanced diagnostics to study both the microwave emission and beam behavior.

7232 (UCRL-CR–108460) **Generation of high-quality petawatt pulses: Final report.** Mourou, G. (Michigan Univ., Ann Arbor, MI (United States)); Bado, Philippe. Lawrence Livermore National Lab., CA (United States); Michigan Univ., Ann Arbor, MI (United States). [1991]. 28p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE92003965. Source: OSTI; NTIS; GPO Dep.

CPA sources need a front-end capable of generating very short seed pulses. To meet this requirement, present CPA sources rely on actively modelocked solid-state oscillators used in conjunction with non-linear fiber stages. This approach generates pulses with a residual frequency chirp, resulting in a limited peak-to-background intensity contrast ratio. The availability of an oscillator capable of producing directly (i.e. without fiber stage) picosecond or subpicosecond pulses would significantly improve the quality of CPA sources. We have pursued different approaches to replace the standard modelocked oscillator front-end. In an initial phase, we investigated the possible use of Additive Pulse Modelocking (APM) color-center lasers as oscillators for CPA Nd:glass sources. Lately we have developed a Ti:Sapphire modelocked oscillator operating in the one-micron range. In order to generate pulses with very high peak to background contrast ratio, we have built a non-linear coupled-cavity oscillator generating 200-fs pulses. This color-center laser operates in the 1.5–1.6 micron range. A diagram of the oscillator is shown in Fig. 1. The laser is pumped with a modelocked Nd:YAG source. Both KCl and NaCl crystals were tested as gain media. NaCl was found to have a larger tuning range and to generate a higher average power (up to 150 mW). When synchronously mode-locked, the color-center generates pulses in the 10–20 ps range. Once interferometrically coupled to non-linear external-cavity, this oscillator produces very short pulses (85 to 260 fs). This oscillator was first operated with a 2 mm birefringent plate. 85 fs, near transform-limited pulses were generated at 1.54 micron. As the laser was tuned to longer wavelength, the pulse duration increased, as well as the bandwidth-duration product. With a 4 mm birefringent plate, 125 fs, transform-limited pulses were generated over the full tuning range.

7233 (UCRL-JC–107363) **Materials for diode pumped solid state lasers.** Chase, L.L.; Davis, L.E.; Krupke, W.F.; Payne, S.A. Lawrence Livermore National Lab., CA (United States). 14 Jul 1991. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-910717–1: 2. international laser conference: material engineering, medicine, biology, physics and chemistry, Grenoble (France), 9-11 Jul 1991). Order Number DE92003973. Source: OSTI; NTIS; GPO Dep.

The advantages of semiconductor diode lasers and laser arrays as pump sources for solid state lasers are reviewed. The properties desired for solid state laser media for various diode pumping applications are discussed, and the characteristics of several promising media are summarized. 13 refs., 4 tabs.

7234 (UCRL-JC–107982) **Soft x-ray laser source development and applications: Worldwide progress.** Keane, C.J. Lawrence Livermore National Lab., CA (United States). Oct 1991. 50p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9107115–62: Society of Photo-Optical Instrumentation Engineers (SPIE) meeting, San Diego, CA (United States), 21-26 Jul 1991). Order Number DE92005248. Source: OSTI; NTIS; INIS; GPO Dep.

The field of soft x-ray laser research is at a point between the first demonstrations of x-ray amplification and the onset and widespread application of modest-sized x-ray lasers. The past several years have seen great strides in x-ray amplifier performance as well as the demonstration of proof-of-principle x-ray laser applications. In the near term, the challenge for the x-ray laser community will be to develop compact x-ray lasers and to carry out an applications experiment of crucial importance to an identifiable community of interested users. Achieving these goals will require furthering our understanding of basic amplifier physics and increasing our technological capabilities with x-ray lasers. In this paper, we summarize the results obtained to date in these areas, with emphasis on the most recent developments. 146 refs., 11 figs.

7235 (UCRL-JC-108670) **Soft x-ray projection lithography system design and cost analysis.** Ceglio, N.M.; Hawryluk, A.M. Lawrence Livermore National Lab., CA (United States). Jul 1991. 20p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9107115-60: Society of Photo-Optical Instrumentation Engineers (SPIE) meeting, San Diego, CA (United States), 21-26 Jul 1991). Order Number DE92004661. Source: OSTI; NTIS; GPO Dep.

A baseline model providing technical performance specifications and preliminary cost assessments for a prototype Soft X-ray Projection Lithography (SXPL) system is presented. We find that the technical performance requirements for components of the SXPL system are beyond the current state of the technology. We have also conducted a wafer cost analysis for the proposed SXPL system. In our parametric analysis of normalized wafer exposure costs we find that variations in direct cost items (e.g., resist, mask optics, laser) have a small effect on wafer costs. More important are variations in variations in the performance of technical parameters which affect wafer throughput. Of these, mirror reflectivity is by far the most important, followed by optical design (which can reduce the number of mirrors), then parameters related to x-ray generation and collection, and finally resist sensitivity. The lifetime of multilayer coatings is not by itself a critical parameter in determining wafer exposure costs. However, the repairability of such coatings can be important. Indeed, if mirror replacement is required when coatings degrade (i.e., nonrepairable), then mirror lifetime becomes about as important as resist sensitivity in determining wafer exposure costs.

4270 Nuclear Explosions

7236 (LA-12189-MS) **Some new ideas for nuclear explosive spacecraft propulsion.** Solem, J.C. Los Alamos National Lab., NM (United States). Oct 1991. 17p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract W-7405-ENG-36. Order Number DE92003009. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Because of the deleterious effects of galactic cosmic radiation, solar flares, zero gravity, and psychological stress, there is a strong motivation to develop high-specific-impulse and high-thrust spacecraft for rapid transport of astronauts between the planets. I present a novel spacecraft design using a large lightweight sail (spinnaker) driven by the pressure pulses from a series of nuclear explosions. The spacecraft appears to be a singularly competent and economical vehicle for high-speed interplanetary travel. Remarkably, the mass of the spinnaker is theoretically independent of the size of its canopy or the number or length of its tethers. Consequently, the canopy can be made very large to minimize radiation damage from the nuclear explosions and the tethers can be made very long to mitigate radiation hazard to the crew. I calculate the specific impulse of the nuclear explosive propellant as a function of the mass and yield of the explosives and the thrust as a function of yield and repetition rate. I show that the weight of the sail can be greatly reduced by tethering the canopy in many places on its surface and that the canopy mass is directly proportional to the bomb yield and inversely proportional to the number of tethers. The pressure from the nuclear explosion imparts a large impulsive acceleration to the lightweight spinnaker, which must be translated to a small smooth acceleration of the space capsule by using either the elasticity of the tethers or a servo winch in the space capsule or a combination of the two. Finally, I derive the optimum canopy shape and show that it will generally intercept about 2π of the solid angle from the detonation point. Should the political questions connected with this unconventional use of nuclear explosives be favorably resolved, the invention will be a good candidate for propulsion in the Mars mission.

43 PARTICLE ACCELERATORS

Refer also to citation(s) 7868

7237 (BNL-46849) **An organizational survey of the Stanford Linear Accelerator Center.** Shurberg, D.A.; Haber, S.B. Brookhaven National Lab., Upton, NY (United States). Nov 1991. 49p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE92005446. Source: OSTI; NTIS; GPO Dep.

At the request of the Department of Energy, an Organizational Survey (OS) was administered at the Stanford Accelerator Center (SLAC). The OS measured employees' opinions on subjects such as organizational culture, communication, commitment, group cohesion, coordination, safety, environmental issues, and job satisfaction. The result of this work was a quantitative measure of the notion of culture at the SLAC site. This report presents these results and discusses their interpretation.

7238 (INS-T-502) **Third collection of technical reports, 1991.** Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Mar 1991. 44p. (In Japanese). Order Number DE92751078. Source: OSTI; NTIS (US Sales Only); INIS.

On February 7, 1991, the third technological report meeting by the engineers in the Institute for Nuclear Study, University of Tokyo, was held as a part of the study and training curriculum in the Institute for Nuclear Study. In the report meeting, three general reports and three reports of official overseas trips were carried out, and these are summarized in this book. It shows the activities of INS engineers in wide fields and the standpoint of engineers in a university research institute clearly. In addition, it seems effective for the interchange in the institute and the technological advance. Though the every day activities of the engineers are diverse, the general reports were only three, and it is a little regrettable. In April, 1990, a step was taken for establishing the system for engineers also in University of Tokyo, and for accelerating this move further to 'special administration post', the technological report meeting and the collection of reports like these have important significance. Three general reports are on NC milling machine, high frequency acceleration in TARN2, and making of CAMAC branch driver for multi-functional terminals in INS. (K.I.).

4301 Design, Development, and Operation

Refer also to citation(s) 7869

7239 (BNL-52272) **National Synchrotron Light Source: Annual report, October 1, 1989-September 30, 1990.** Hulbert, S.L.; Lazarz, N.M. (eds.). Brookhaven National Lab., Upton, NY (United States). Apr 1991. 380p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE92005348. Source: OSTI; NTIS; INIS; GPO Dep.

This report discussion research being conducted at the National Synchrotron light source. In particular, this report contains operations summaries; symposia, workshops, and projects; NSLS highlights; and abstracts of science at the NSLS. (LSP)

7240 (INIS-BR-2883, pp. 40) **Group: the accelerator of heavy ions Pelletron 20 UD for radiobiological use.** Associacao Brasileira de Fisicos em Medicina, Rio de Janeiro, RJ (Brazil). 1990. 61p. (In Spanish). (CONF-9010386-: 12. Brazilian Congress on Biomedical Engineering and 5. Latin American Conference on Medical Physics, Ribeirao Preto (Brazil), 7-11 Oct 1990). In *Proceedings of the 5. Latin American Meeting on Medical Physics; 2. Workshop on Medical Physics; 1. Workshop on Medical Physics and Biomedical Engineering.* Order Number DE92613627. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. PELLETRON ACCELERATORS/heavy ions; RADIOBIOLOGY; SPECIFICATIONS

7241 (INS-892) **Development of an SCRFQ heavy-ion linac for RI beams.** Arai, S.; Imanishi, A.; Morimoto, T.; Tojyo, E.;

Tokuda, N.; Shibuya, S. Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Sep 1991. 15p. Order Number DE92751047. Source: OSTI; NTIS (US Sales Only); INIS.

A split coaxial RFQ (SCRFQ) is being developed to accelerate RI beams from 1 to 170 keV/u in the Japanese Hadron Project (JHP). Our SCRFQ is equipped with modulated vanes. On the basis of the studies on a cold model and a proton accelerating one, a 25.5-MHz prototype for the JHP SCRFQ has been constructed. The prototype consisting of three module-cavities is 2.1 m in length and 0.9 m in inner diameter, and accelerates ions with a charge-to-mass ratio (q/A) greater than 1/30 from 1 to 45.4 keV/u. The measured unloaded Q-value of the cavity is 6400 corresponding to about 84% of a calculated value, and the field imbalance between vanes is within ±0.6%. The designed intervane voltage of 109 kV for ions with q/A = 1/30 is achieved with a 70 kW peak power. By using ions of three species N_2^+, N^+ and Ne^+, acceleration tests are conducted. The transmission efficiency attained with a N^+ beam is better than 80% at normalized intervane voltages higher than 1.2. (author).

7242 (KEK–90-25(v.1), pp. 5-13) **ISIS status report.** Finney, J.L. (Rutherford Appleton Lab., Chilton (United Kingdom)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

Two years back, I reported at ICANS X that ISIS was running regularly at 100 μA, 750 MeV, with 9 scheduled neutron instruments and one muon beam line. Overall efficiency, measured as a percentage of time beam on target, was about 72%, and our stated priority was to improve reliability at 100 μA current. Over the past two years, major improvements have been made to several component parts of the system, and reliability so far in 1990 is just below 80%. Regular running periods at 100 μA have been achieved, with 100 μA average current achieved over a period of over a week. On 3 November 1989 a record integrated current over 24 hours of 2571 μA hrs was obtained. Trip rates have been significantly reduced. Three more neutron instruments are now scheduled, bringing the total to 12 neutron and 1 muon instruments. Around 350 neutron experiments were run in the 7 cycles of 1989, and about the same number are expected to be run in the 6 cycles of 1990. (author).

7243 (KEK–90-25(v.1), pp. 14-31) **Intense pulsed neutron source status report.** Brown, B.S. (Argonne National Lab., IL (United States)); Bohringer, D.E.; Brumwell, F.R.; Carpenter, J.M.; Crawford, R.K.; Rauchas, A.V.; Schulke, A.W.; Worlton, T.G. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

The status and future plans of IPNS will be reviewed. At the celebration of our 10th anniversary in 7 months, IPNS will have performed over 2000 experiments and has over 230 scientists visiting IPNS annually. Plans for a new spallation source concept using a fixed field alternating gradient synchrotron will be presented. (author).

7244 (KEK–90-25(v.1), pp. 41-60) **SINQ: status report Oct. 1990.** Bauer, G.S. (Paul Scherrer Inst. (PSI), Villigen (Switzerland)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

After a lengthy period of 'digging-work' which started on 8-8-88 to build the 11 m deep proton transport tunnel, most of the concrete work is now complete and the steel structure for the target and neutron guide halls has been erected. Design work on the target- and supplies system is progressing well and a basis for the safety analysis report has been established. Besides investigations towards protection against air-plane crash and earthquake this also includes research to determine the retention factor of lead-bismuth for polonium and mercury. Studies on the lead bismuth thermal hydraulics and on the D_2-cold moderator system have so far confirmed our expectations and are still in progress. Also in progress is an irradiation endurance test on the target window material at Los Alamos. In addition to intensive development work on the liquid metal target, research on a lead pebble bed target has been initiated. (author).

7245 (KEK–90-25(v.1), pp. 61-74) **Status of KENS-I' and KENS-II.** Watanabe, N. (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

Present status of the KENS facility (KENS-I') is reported here especially on the recent progress in instrumentation. Design concept of the KENS-II target station is briefly described with the results of recent R and D. (author).

7246 (KEK–90-25(v.1), pp. 87-99) **Neutron facilities of Moscow meson and kaon factories.** Stavissky, Yu.Ya. (AN SSSR, Moscow (USSR). Inst. Yadernykh Issledovanij). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

The questions of new generation of intensive pulse neutron sources for elementary interaction physics, neutron nuclear physics, solid state and radiation physics, on the base of Moscow meson and projected kaon factories are discussed. (author).

7247 (KEK–90-25(v.1), pp. 100-108) **Pulsed neutron sources at KAON.** Thorson, I.M. (TRIUMF, Vancouver, BC (Canada)); Egelstaff, P.A.; Craddock, M.K. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

The proposed KAON Factory facility at TRIUMF consists of a number of synchrotrons and storage rings which offer proton beams of energies between 0.45 and 30 GeV with varying pulse amplitudes, widths and repetition rates. Various possibilities for feeding these beams to a pulsed neutron facility and their potential for future development are examined. The incremental cost of such a pulsed neutron facility is estimated approximately. (author).

7248 (KEK–90-25(v.1), pp. 140-155) **Progress of the accelerator R and D for the Japanese Hadron Project.** Kihara, Motohiro (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

This paper will describe the general idea of the JHP facility, primarily from the accelerator's point of view, and up-to-data results of the research and development on accelerator components. Among others, the R and D on the proton linac has been pursued at the KEK Laboratory since 1987, efforts having been devoted mainly to the development of prototype rf power sources, the rf structure development for the coupled-cell linac and the realization of a 10-MeV linac. The R and D study on the heavy-ion linac has been made at Institute for Nuclear Study, University of Tokyo, primarily on the split-coaxial RFQ linac. (author).

7249 (KEK-90-25(v.1), pp. 179-189) **Design of the compressor/stretcher ring of the Japanese Hadron Project.** Ohmori, C. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study); Noda, A.; Kimiya, Y.; Kihara, M.; Yamane, I. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243-: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

A possibility of adopting a racetrack-type design for the compressor/stretcher ring of the Japanese Hadron Project is described. This design has two long straight sections to enable to inject the H$^-$ beam and to produce a high β point for the slow extraction. (author).

7250 (KEK-90-25(v.1), pp. 199-209) **On the way to high-power linear proton accelerator for the long half-life radionuclides transmutation.** Batskikh, G.I. (AN SSSR, Moscow (USSR). Radiotekhnicheskij Inst.); Lupandin, O.S.; Murin, B.P.; Fedotov, A.P. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243-: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

The concept of continuous mode high-power linear proton accelerator with 1.5 GeV energy, 0.3 A current for the long half-life nuclides transmutation into the short ones (waste of atomic power plants (APP)) is proposed. The accelerator design main principles, scheme and parameters are presented. The accent is made on the accelerator efficiency, reliability and radiation purity. (author).

7251 (KEK-90-25(v.1), pp. 134-139) **General aspects of the ISIS upgrade.** Broome, T.A. (Rutherford Appleton Lab., Chilton (United Kingdom)); Gardner, I.S.K.; Rees, G.H. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243-: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

The planned ISIS upgrade program for the accelerator and target station is described. This program aims at the increase of the synchrotron energy from 750 MeV to 800 MeV, and the increase of the intensity from 100 μA towards 200 μA, and also continuing the improvement of the reliability of the facility. In addition, some longer term development is mentioned. As the upgrade program for the accelerator and target station was detailed before, in this conference, only brief outline of the work is given. The main effort in the last two years has been directed at improving the accelerator reliability and reducing the frequency of beam trips which seem to shorten the life time of a uranium target. The failure of targets is discussed. The required and achieved performance figures of the accelerator are shown. The KFK/RAL improvement program is outlined. It was started in 1990, and all the hardwares are expected to be installed by April, 1993. Other development areas are reported. In the target station development, the targets with better resistance to thermal cycling damage will be developed. The design of a second target station for ISIS is considered. (K.I.).

7252 (KEK-90-25(v.1), pp. 279-287) **The accelerator complex of the Moscow Kaon Factory.** Chursin, A.G. (AN SSSR, Moscow (USSR). Inst. Yadernykh Issledovanij); Dubinsky, G.A.; Esin, S.K. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243-: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

The tuning of the linear accelerator in the present Moscow Meson Factory is about to be completed, and the first 600 MeV protons are going to be obtained this year. In accordance with the resolution on high energy physics of the USSR government, the project of Moscow Kaon Factory (MKF) has been designed since 1987. Four institutes collaborate and contribute to the development of the Kaon Factory project, and the proposal of the Moscow Kaon Factory was finished. In the proposal, the linear accelerator in the Moscow Meson Factory is to be used as the injector for the booster which is the first step of the MKF accelerator complex. After charge exchange injection, the H$^+$ beam is accelerated in the booster from 0.6 GeV to 7.5 GeV, and in the main ring, from 7.5 GeV to 45 GeV. At the end of acceleration, the 45 GeV beam is transferred from the main ring to the extender, then extracted slowly with 100% duty cycle. The time-energy structure of the accelerator complex, injection from the linear accelerator, the requirement for the lattice design, booster lattice, extender and synchrotron lattice, slow extraction, RF cavities and beam stability are described. (K.I.).

7253 (LA-UR-91-3436) **Proceedings of the PILAC optics workshop.** Los Alamos National Lab., NM (United States). Nov 1991. 650p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-9108183-: PILAC optics workshop, Los Alamos, NM (United States), 12-13 Aug 1991). Order Number DE92004653. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains viewgraphs on the following topics: PILAC Overview; PILAC Injection Line; PILAC General-Purpose Line Design; Program RAYTRACE; Design & Performance of MRS; Program MOTER; Recent Upgrades of MOTER; Use of MOTER at Michigan State; Spectrometer Design at Michigan State; Use of MOTER at CEBAF & Related Topics; TOSCA Calculations at CEBAF; TOSCA Calculations for PILAC; Measurements of EPICS Quadrupoles; Quadrupole Measurements and Analysis at Bates Laboratory; Analysis of 3D Quadrupole Data; Quadrupole 3D Fringe Fields (Theoretical Lecture); Analysis of 3D Field Data; Analysis of Dipole Fringe Fields; Quadrupoles with Perfect N=2 Symmetry; CEBAF Superconducting Cos (20) Quadrupole; Upgrades to TRANSPORT and TURTLE; Optics using Differential Algebra; and A Possible Test of Quad Optics Using EPICS.

7254 (SLAC-PUB-5709) **The tau-charm factory: Concept and construction.** Perl, M.L.; Niemi, G.D. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Dec 1991. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-911106-32: IEEE nuclear science symposium, Santa Fe, NM (United States), 5-9 Nov 1991). Order Number DE92004773. Source: OSTI; NTIS; INIS; GPO Dep.

The first part of this paper explains the tau-charm factory concept: a high luminosity, low-energy, two-ring, electron-positron collider which enables precise and probing studies of the physics of the charm quark, tau lepton, and tau neutrino. The second part describes the plans for construction of a tau-charm factory in Spain. 28 refs., 2 figs., 1 tab.

7255 (UM-P-91/37) **The access control and radiation monitoring system for the Austin Hospital PET Centre.** Egan, G.F. (Austin Hospital, Heidelberg (Australia)). Melbourne Univ., Parkville (Australia). School of Physics. [1991]. 9p. Order Number DE92613725. Source: OSTI; NTIS (US Sales Only); INIS.

A Positron Emission Tomography Centre is being established at the Austin Hospital, Melbourne. The cyclotron vault and hotcell laboratories have been categorized according to the National Council on Radiation Protection and Measurements guidelines for access control to radiation areas. An access control system incorporating visual alarm systems, signs, barriers and interlocks has been designed for the safe operation of the Centre. These features are briefly described. 6 refs., 1 fig.

4302 Beam Dynamics, Field Calculations, and Ion Optics

Refer also to citation(s) 7208, 7210, 7300, 7305, 7367, 7379, 7386, 8297, 8407

7256 (BNL-46668) **Beam tracking of SXLS with realistic magnetic field.** Huang, Yun-Xiang. Brookhaven National Lab., Upton, NY (United States). Sep 1991. 31p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE92004994. Source: OSTI; NTIS; INIS; GPO Dep.

In early 1977, while working for NSLS at Brookhaven National Lab., Dr. Ohnuma noticed that tunes of NSLS calculated with code SYNCH were significantly different from those obtained with code PATRICIA. This problem surfaced again in 1991 when people at BNL discovered discrepancies in their compact ring SXLS chromaticities calculated with different code. One potential source of the ambiguities is the different treatment of the edge field and the combined function field of dipole magnet. There are two dipoles each of which with the bending angle of 180° instead of at most a few degrees which is common in high energy synchrotrons. The calculation of a three-dimensional field using TOSCA indicates that the fringe field extends to cover the whole region between the dipole and the quadrupole, having a vertical field strength of 250 gauss at the edge of the quadrupole. In this case, the fringe multiple field will undoubtedly play a nontrival role in determining basic machine parameters. Therefore, the classical treatment for simulating particle motion in synchrotron, which uses the isomagnetic approximation plus then lens kicks, no longer accurately models the closed orbit of the machine. In order to correctly calculate tunes, chromaticities as well as the dynamic aperture in such kind of machine with a large magnetic bending angle, it is necessary to integrate the exact equations of motion in a realistic representation of the magnetic field.

7257 (BNL--46751) **Exact analysis to any order of the linear coupling problem in the thin lens model.** Ruggiero, A.G. Brookhaven National Lab., Upton, NY (United States). [1991]. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-9110243--7: 5. International Committee for Future Accelerators (ICFA) beam dynamics workshop, Corpus Christi, TX (United States), 3-8 Oct 1991). Order Number DE92005005. Source: OSTI; NTIS; INIS; GPO Dep.

In this report we attempt the exact solution of the motion of a charged particle in a circular accelerator under the effects of skew quadrupole errors. We adopt the model of error distributions, lumped in locations with zero extensions. This thin-lens approximation provides an analytical insight to the problem to any order. The total solution is expressed in terms of driving terms which are actually correlation factors to several order. An application follows on the calculation and correction of tune-splitting and on the estimate of the role the higher-order terms play in the correction method.

7258 (BNL--46792) **Stochastic cooling with a double rf system.** Wei, J. Brookhaven National Lab., Upton, NY (United States). Oct 1991. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (AD/RHIC--105). Order Number DE92004995. Source: OSTI; NTIS; INIS; GPO Dep.

Stochastic cooling for a bunched beam of hadrons stored in an accelerator with a double rf system of two different frequencies has been investigated. The double rf system broadens the spread in synchrotron-oscillation frequency of the particles when they mostly oscillate near the center of the rf bucket. Compared with the case of a single rf system, the cooling rate is significantly increased. When the rf voltage is raised, the reduction rate of the emittance, instead of decreasing linearly, now is independent of the ratio of the bunch area to the bucket area. With the double rf system, the spread in synchrotron-oscillation frequency is small for particles with synchrotron-oscillation amplitudes comparable to the dimension of the rf bucket. Consequently, stochastic cooling becomes less effective when the bunch area is close to the bucket area.

7259 (BNL--46840) **Electron beam optics for the FEL experiment and IFEL experiment.** van Steenbergen, A. Brookhaven National Lab., Upton, NY (United States). [1990]. 30p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE92005049. Source: OSTI; NTIS; INIS; GPO Dep.

Electron beam transport system parameters for the FEL experiment and for the FEL experiment are given. The perturbation of the "interaction region" optics due to wiggler focussing is taken into account and a range of solutions are provided for relevant Twiss parameters in the FEL or IFEL region. Modifications of the transport optics in specific sections of the overall beam transport lines, for reasons of enhanced diagnostic capability or enhanced beam momentum analysis resolution, is also presented.

7260 (ENEA-RT-INN--90-32) **Bi-unitary transformation and ordinary differential equations: Part 3.** Dattoli, G.; Loreto, V.; Mari, C.; Richetta, M.; Torre, A. ENEA, Frascati (Italy). Dipt. Sviluppo Tecnologie di Punta. Sep 1991. 20p. (RT/INN--90-32). Order Number DE92744018. Source: OSTI; NTIS (US Sales Only).

In two previous papers, the authors introduced the concept of binormal differential equations. It was shown that invariants of the Courant-Snyder type are associated with the scalar products of the column vectors associated to an ordinary differential equation and to its binormal. This paper shows the equivalence of the above invariant and the Lewis form. It also introduces a density matrix for a second-order differential equation and clarifies the geometrical meaning of Twiss parameters. Within the framework of accelerator physics, the importance of the above results in the analysis of quantum problems such as the evolution of squeezed states is stressed.

7261 (ENEA-RT-INN--90-49) **Wave theory of charged beam propagation.** Dattoli, G.; Gallerano, G.P.; Giannessi, L.; Richetta, M.; Torre, A. ENEA, Frascati (Italy). Dipt. Sviluppo Tecnologie di Punta. Jun 1991. 24p. (RT/INN--90-49). Order Number DE92744016. Source: OSTI; NTIS (US Sales Only).

Using a recent quantum mechanical treatment of charged beam propagation in which the emittance plays the role of Planck's constant, this paper constructs a wave theory of the beam transport along guiding systems. It shows that the distribution of a beam passing through quadrupole lenses can be described in terms of gaussian beams; discusses the role of Twiss parameters within this context; and derives an ABCD law for charged beam transport.

7262 (ENEA-RT-INN--90-50) **Perturbative analysis of Kapchinskij-Vladimirskij problem in emittance dominated regime.** Dattoli, G.; Giubileo, C.; Mezi, L.; Richetta, M.; Ronsivalle, C.; Torre, A. ENEA, Frascati (Italy). Dipt. Sviluppo Tecnologie di Punta. Jun 1991. 14p. (RT/INN--90-50). Order Number DE92744011. Source: OSTI; NTIS (US Sales Only).

Making reference to the Kapchinskij-Vladimirskij electron beam envelope evolution equation, this paper presents a first order perturbative analysis of the space-charge effect on a charged beam with cylindrical symmetry. Particular attention is given to the modification induced in the propagation through a drift space and a thin lens.

7263 (ENEA-RT-INN--90-54) **Formal quantum theory of electronic rays.** Dattoli, G.; Giannessi, L.; Mari, C.; Richetta, M.; Torre, A. ENEA, Frascati (Italy). Dipt. Sviluppo Tecnologie di Punta. Jun 1991. 21p. (RT/INN--90-54). Order Number DE92744012. Source: OSTI; NTIS (US Sales Only).

A quantum theory of charged beam propagation in transport magnetic structures is developed. The time coordinate of quantum mechanics is replaced by the propagation coordinate and the beam emittance takes the place of Planck's constant. Coherent beam distributions are also discussed.

7264 (ENEA-RT-INN--90-60) **Coupled transverse motion in charged beam transport dynamics and generalized Twiss coefficients.** Dattoli, G.; Mari, C.; Ronsivalle, C.; Torre, A. ENEA, Frascati (Italy). Dipt. Sviluppo Tecnologie di Punta. Apr 1991. 14p. (RT/INN--90-60). Order Number DE92744006. Source: OSTI; NTIS (US Sales Only).

Within the framework of accelerator physics beam dynamics modelling, this paper discusses a generalized Courant-Snyder theory for n-dimensional quadratic Hamiltonians. It stresses the usefulness of the obtained results both for transverse mode coupling in accelerators and in quantum mechanics for the generation of squeezed states.

7265 (ENEA-RT-INN--90-68) **Twiss parameters and evolution of quantum harmonic oscillator states.** Dattoli, G.; Gallerano, G.P.; Mari, C.; Torre, A.; Richetta, M. ENEA, Frascati (Italy). Dipt. Sviluppo Tecnologie di Punta. Jun 1991. 22p. (RT/INN--90-68). Order Number DE92744013. Source: OSTI; NTIS (US Sales Only).

This paper shows that the evolution of a quantum state, driven by a harmonic oscillator type Hamiltonian, can be studied by using tools exploited to characterize the evolution of a charged beam in a transport channel. Within the framework of accelerator physics, the relevance of the Courant-Snyder invariant and of Twiss-like parameters to characterize, e.g., the amount of squeezing, is carefully pointed out.

7266 (ENEA-RT-INN–90-70) **Ordinary differential equation with non constant coefficients theory: Miscellaneous results.** Dattoli, G.; Giannessi, L.; Mari, C.; Richetta, M.; Torre, A. ENEA, Frascati (Italy). Dipt. Sviluppo Tecnologie di Punta. Jun 1991. 26p. Order Number DE92744017. Source: OSTI; NTIS (US Sales Only).

Within the framework of accelerator physics beam dynamics problems, this paper applies the Courant-Snyder theory to second-order ordinary differential equations with non-constant complex coefficients. The same theory is exploited in the case of third-order equations with non-constant real coefficients. The usefulness of the Magnus expansion to get approximate solutions is finally discussed.

7267 (ENEA-RT-INN–90-72) **XUV FELs by harmonics amplification: Parametric analysis in two-undulator schemes.** Dipace, A.; Sabia, E. ENEA, Frascati (Italy). Dipt. Sviluppo Tecnologie di Punta. Jun 1991. 16p. (RT/INN–90-72). Order Number DE92744015. Source: OSTI; NTIS (US Sales Only).

A two-undulator FEL (free electron laser) amplifier for the production of XUV (extreme ultraviolet) radiation by harmonics generation is analyzed in the framework of the exponential gain regime. Some criteria to design the composite undulator are then described.

7268 (FNAL/C–91/300) **Longitudinal beam dynamics at transition crossing.** Bogacz, S.A. Fermi National Accelerator Lab., Batavia, IL (United States). Nov 1991. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-9110243–6: 5. International Committee for Future Accelerators (ICFA) beam dynamics workshop, Corpus Christi, TX (United States), 3-8 Oct 1991). Order Number DE92004122. Source: OSTI; NTIS; INIS; GPO Dep.

A brief outline of the longitudinal single particle dynamics at transition is presented in terms of phase-space mappings. Simple quantitative prediction about the phase-space dilution is made. More realistic simulation (ESME) of the transition crossing is carried out (including various collective and single particle effects contributing to the longitudinal emittance blow up). The simulation takes into account the longitudinal space-charge force (bunch length oscillation), the transverse space-charge (the Umstaetter effect) and finally the dispersion of the momentum compaction factor (the Johnsen effect). As a result of this simulation one can separate relative strengths of the above mechanisms and study their individual effects on the longitudinal phase-space evolution, especially filamentation of the bunch and formation of a "galaxy-like" pattern. 7 refs., 2 figs.

7269 (INIS-mf–13026, pp. 297-298) **Beam current monitor and scanning system for the race-track microtron.** Dhole, S.D. (Poona Univ., Pune (India). Dept. of Physics); Bhoraskar, V.N. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. RACETRACK MICROTRONS/beam monitoring; RACETRACK MICROTRONS/beam scanners; BEAM CURRENTS; CALIBRATION; ELECTRIC POTENTIAL; ELECTRON BEAMS; FARADAY CUPS; MEV RANGE 01-10

7270 (INIS-mf–13026, pp. 313-314) **Combined operation of the light and heavy ion bunchers of the NSC pelletron for increasing the efficiency.** Prakash, P.N. (Nuclear Science Centre, Delhi (India)); Patro, A.P. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. 5 refs. PELLETRON ACCELERATORS/beam bunching; BEAM BUNCHERS; BEAM PULSERS; COMPUTERIZED SIMULATION; EFFICIENCY; ENERGY; HEAVY IONS; LIGHT IONS; MODULATION; TUBES

7271 (Juel–2499) **First turn simulations in the cooler synchrotron COSY.** Dinev, D. Forschungszentrum Juelich GmbH (Germany). Inst. fuer Kernphysik. Jul 1991. 54p. Order Number DE92758898. Source: OSTI; NTIS (US Sales Only); INIS.

This paper is devoted to the first turn correction and related problems in particle accelerators of synchrotron type. The paper consists of two parts. The first part is a survey of the existing methods for first turn steering. The second part is entirely devoted to the first turn in the cooler synchrotron COSY which is under assembling in KFA-Julich, Germany. (orig.).

7272 (KEK–90-21, pp. 135-137) **High frequency behavior of the coupling impedance for a large number of obstacles.** Gluckstern, R.L. (Maryland Univ., College Park, MD (United States)); Li, R. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Feb 1991. (CONF-9009292–: 4. advanced ICFA beam dynamics workshop on collective effects in short bunches, Tokyo (Japan), 22-29 Sep 1990). In *Fourth advanced ICFA beam dynamics workshop on collective effects in short bunches.* 202p. Order Number DE92713858. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. IMPEDANCE/storage rings; FREQUENCY DEPENDENCE; COUPLING; IMPEDANCE; INSTABILITY; BEAM BUNCHING; OSCILLATIONS; ANALYTICAL SOLUTION

7273 (KEK–90-21, pp. 138-141) **Measurement of the asymptotic behavior of the high frequency impedance.** Hofmann, A. (European Organization for Nuclear Research, Geneva (Switzerland)); Risselada, T.; Zotter, B. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Feb 1991. (CONF-9009292–: 4. advanced ICFA beam dynamics workshop on collective effects in short bunches, Tokyo (Japan), 22-29 Sep 1990). In *Fourth advanced ICFA beam dynamics workshop on collective effects in short bunches.* 202p. Order Number DE92713858. Source: OSTI; NTIS (US Sales Only); INIS.

A new evaluation of old measurements of the parasitic mode loss in the ISR shows that the asymptotic frequency dependence is very close to the inverse square root which has been found analytically for single cavities. (author).

7274 (KEK–90-21, pp. 142-150) **Short-range impedance.** Yokoya, Kaoru (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Feb 1991. (CONF-9009292–: 4. advanced ICFA beam dynamics workshop on collective effects in short bunches, Tokyo (Japan), 22-29 Sep 1990). In *Fourth advanced ICFA beam dynamics workshop on collective effects in short bunches.* 202p. Order Number DE92713858. Source: OSTI; NTIS (US Sales Only); INIS.

Short-range wake functions are usually obtained using time-domain computer programs. We demonstrate that frequency domain methods can also be usefully applied to this end. In addition, we show that the speed and ease of the required computations can be greatly improved if the calculations are performed at complex, rather than at real, frequencies. (author).

7275 (KEK–90-21, pp. 151-160) **Shielded coherent synchrotron radiation and its effect on very short bunches.** Warnock, R.L. (Stanford Linear Accelerator Center, Menlo Park, CA (United States)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Feb 1991. (CONF-9009292–: 4. advanced ICFA beam dynamics workshop on collective effects in short bunches, Tokyo (Japan), 22-29 Sep 1990). In *Fourth advanced ICFA beam dynamics workshop on collective effects in short bunches.* 202p. Order Number DE92713858. Source: OSTI; NTIS (US Sales Only); INIS.

Shielded coherent synchrotron radiation is discussed for two cases: (1) a beam following a circular path midway between two parallel conducting plates, and (2) a beam circulating in a toroidal chamber. Wake fields and the energy radiated are computed for both cases. Under conditions like those of the high-energy bunch compressor of the Next Linear Collider (NLC), in which bunches as short as 40 microns are contemplated, the shielded coherent radiated power is estimated to be small compared to the incoherent power, but can still amount to a few hundred KeV over the compressor arc. (author).

7276 (KEK–90-21, pp. 161-170) **Impedance scaling and synchrotron radiation intercept.** Chou, W. (Superconducting Super Collider Lab., Dallas, TX (United States)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Feb 1991. (CONF-9009292–: 4. advanced ICFA beam dynamics workshop on collective effects in short bunches, Tokyo (Japan), 22-29 Sep 1990). In *Fourth advanced ICFA beam dynamics workshop on collective effects in short bunches.* 202p. Order Number DE92713858. Source: OSTI; NTIS (US Sales Only); INIS.

This paper presents several scalings in 2-D and 3-D impedance calculations. Most of the scalings are empirical and are found by using the boundary perturbation method and numerical simulations. As an application of these scalings, it is calculated, the impedance of one type of the synchrotron radiation intercept. The results are then compared with that of several other types of intercept designs. (author).

7277 (KEK–90-21, pp. 171-180) **Coherent synchrotron radiation.** Nakazato, T. (Tohoku Univ., Sendai (Japan). Lab. of Nuclear Science). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Feb 1991. (CONF-9009292–: 4. advanced ICFA beam dynamics workshop on collective effects in short bunches, Tokyo (Japan), 22-29 Sep 1990). In *Fourth advanced ICFA beam dynamics workshop on collective effects in short bunches.* 202p. Order Number DE92713858. Source: OSTI; NTIS (US Sales Only); INIS.

The complete spectrum of coherent synchrotron radiation were measured at wavelengths from 0.16 to 3.5 mm. A bunch shape was estimated by the Fourier analysis for this spectrum. This result agrees with that of simulation for the bunching process in the injector of the accelerator. The interferential effects between radiation which were emitted by the different bunches were observed by an interferometer. It was shown that every radiation had the same phase when it was emitted by a bunch. (author).

7278 (KEK–90-21, pp. 181-184) **Coherent synchrotron radiation in LEP.** Rivkin, L. (Paul Scherrer Inst. (PSI), Villigen (Switzerland)); Hofmann, A.; Zotter, B. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Feb 1991. (CONF-9009292–: 4. advanced ICFA beam dynamics workshop on collective effects in short bunches, Tokyo (Japan), 22-29 Sep 1990). In *Fourth advanced ICFA beam dynamics workshop on collective effects in short bunches.* 202p. Order Number DE92713858. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. COHERENT RADIATION/lep storage rings; SYNCHROTRON RADIATION/coherent radiation; BEAM BUNCHING; WAVELENGTHS; SHIELDING; APERTURES; CHARGED PARTICLES; LIMITING VALUES

7279 (KEK–90-21, pp. 185-194) **Coherent radiation in an undulator.** Chin, Y.H. (Lawrence Berkeley Lab., CA (United States)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Feb 1991. (CONF-9009292–: 4. advanced ICFA beam dynamics workshop on collective effects in short bunches, Tokyo (Japan), 22-29 Sep 1990). In *Fourth advanced ICFA beam dynamics workshop on collective effects in short bunches.* 202p. Order Number DE92713858. Source: OSTI; NTIS (US Sales Only); INIS.

This paper is concerned with the synchrotron radiation from an undulating electron beam in a rectangular waveguide. The analysis is based on the dyadic Green's function approach to solve Maxwell's equations in terms of the vector potential. It is shown analytically and numerically that the radiated energy spectrum may differ significantly from the free space result when the undulator length divided by the Lorentz factor of the electron beam is larger than the transverse size of the waveguide. Then, the appearance of the spectrum is changed into a small number of sharp peaks, each corresponding to an excited waveguide mode. The undulator radiation is identified with the wake field in beam instabilities. The concepts of wake function and impedance are introduced to formulate the present problem in the same manner as the beam instability problem, so that the accumulated techniques of the latter can be applied. It is shown that the obtained impedances satisfy the Panofsky-Wenzel theorem and other properties inevitable for wake fields. (author).

7280 (KEK–90-21, pp. 109-115) **Suppression of single bunch beam breakup by BNS damping.** Gluckstern, R.L. (Maryland Univ., College Park, MD (United States). Dept. of Physics); Neri, F.; Van Zeijts, J.B.J. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Feb 1991. (CONF-9009292–: 4. advanced ICFA beam dynamics workshop on collective effects in short bunches, Tokyo (Japan), 22-29 Sep 1990). In *Fourth advanced ICFA beam dynamics workshop on collective effects in short bunches.* 202p. Order Number DE92713858. Source: OSTI; NTIS (US Sales Only); INIS.

The intense narrow beams now used or planned in linear colliders lead to strong wake fields which are capable of increasing the transverse emittance to unacceptable values. A brief analysis of this phenomenon, known as single bunch beam breakup, was outlined for a coasting beam, using the cumulative beam breakup formalism. It was suggested that by decreasing the energy of the tail of a bunch relative to its head, the resulting increased focusing force on the tail of the bunch could offset the effect of single bunch beam breakup. This method is a form of Landau damping now known as BNS damping. A variant of BNS damping in which all particles in a bunch oscillate with the same transverse frequency, amplitude and phase was suggested recently. In this study, the single bunch beam breakup with BNS damping for a uniform coasting beam was analyzed in order to explore the dependence on parameters. An earlier formulation for cumulative beam breakup was used, and finally the transverse beam growth was expressed in terms of two universal parameters. The analysis of single bunch beam breakup and BNS damping is reported. (K.I.).

7281 (KFTI–89-54) **Nonlinear theory of the relativistic electron flow instability in laminated plasma based on the Smith-Purcell effect.** Balakirev, V.A.; Tkach, Yu.V.; Tolstoluzhskij, A.R. AN Ukrainskoj SSR, Kharkov (Ukrainian SSR). Fiziko-Tekhnicheskij Inst. 1989. 19p. (In Russian). Order Number DE92610955. Source: OSTI; NTIS (US Sales Only); INIS.

Linear and non-linear theory of short-wave electromagnetic radiation excitation by an electron beam moving along plasma diffraction lattice is constructed. A case is considered when an electromagnetic wave is emitted at an angle to the beam. It is shown that depending on the beam and plasma parameters both vacuum and plasma radiation excitation regimes can be realized. In the first case instability is linked with charge density show wave energy losses for radiation. The plasma regime is characterized by the fact that the effective dielectric permittivity of the system is negative. In this case beam modulation occurs under effect of the fields induced in plasma. Clusters produced in such a way, emit an electromagnetic wave by crossing the lattice. 9 refs.; 12 figs.

7282 (LBL–30674) **Achromatic and isochronous electron beam transport for tunable free electron lasers.** Bengtsson, J.; Kim, K.J. Lawrence Berkeley Lab., CA (United States). Sep 1991. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (ESG–133;CONF-9108118–34: 13. international free-electron laser (FEL) conference, Santa Fe, NM (United States), 25-30 Aug 1991). Order Number DE92003908. Source: OSTI; NTIS; INIS; GPO Dep.

We have continued the study of a suitable electron beam transport line, which is both isochronous and achromatic, for the free electron laser being designed at Lawrence Berkeley Laboratory. A refined version of the beam transport optics is discussed that accommodates two different modes of FEL wavelength tuning. For the fine tuning involving a small change of the electron beam energy, sextupoles are added to cancel the leading nonlinear dispersion. For the main tuning involving the change of the undulator gap, a practical solution of maintaining the beam matching condition is presented. Calculation of the higher order aberrations is facilitated by a newly developed code. 11 refs., 4 figs., 3 tabs.

7283 (LBL–31242) **Polarized nature of synchrotron radiation.** Kim, K.J. Lawrence Berkeley Lab., CA (United States). Sep 1991. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-9107127–1: Conference on scanning microscopy instrumentation, San Diego, CA (United States), 21-26 Jul 1991). Order Number DE92003903. Source: OSTI; NTIS; INIS; GPO Dep.

Synchrotron radiation is inherently highly polarized, and this fact makes synchrotron radiation useful for probing the directional and/or helical nature of the matter via polarization sensitive experiment. Here we summarize briefly the nature of the polarization experiments and the polarization characteristics of synchrotron radiation. 12 refs., 3 figs.

7284 (SAND-91-2587C) **Phase mixing of transverse oscillations in the linear and nonlinear regimes for IFR relativistic electron beam propagation.** Shokair, I.R. Sandia National Labs., Albuquerque, NM (United States). [1991]. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9106276-4: Charged particle beam conference, Silver Springs, MD (United States), 25-27 Jun 1991). Order Number DE92003956. Source: OSTI; NTIS; INIS; GPO Dep.

Phase mixing of transverse oscillations changes the nature of the ion hose instability from an absolute to a convective instability. The stronger the phase mixing, the faster an electron beam reaches equilibrium with the guiding ion channel. This is important for long distance propagation of relativistic electron beams where it is desired that transverse oscillations phase mix within a few betatron wavelengths of injection and subsequently an equilibrium is reached with no further beam emittance growth. In the linear regime phase mixing is well understood and results in asymptotic decay of transverse oscillations as $1/Z^2$ for a Gaussian beam and channel system, Z being the axial distance measured in betatron wavelengths. In the nonlinear regime (which is likely mode of propagation for long pulse beams) results of the spread mass model indicate that phase mixing is considerably weaker than in the regime. In this paper we consider this problem of phase mixing in the nonlinear regime. Results of the spread mass model will be shown along with a simple analysis of phase mixing for multiple oscillator models. Particle simulations also indicate that phase mixing is weaker in nonlinear regime than in the linear regime. These results will also be shown. 3 refs., 4 figs.

7285 (SLAC-PUB-5294) **Observation and analysis of oscillations in linear accelerators.** Seeman, J.T. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Nov 1991. 22p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-890786-4: US particle accelerator school, Upton, NY (United States), 24 Jul - 4 aug 1989). Order Number DE92004715. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the following on oscillation in linear accelerators: Betatron Oscillations; Betatron Oscillations at High Currents; Transverse Profile Oscillations; Transverse Profile Oscillations at High Currents.; Oscillation and Profile Transient Jitter; and Feedback on Transverse Oscillations.

7286 (SLAC-PUB-5695) **Review of lattice measurement techniques at the SLC.** Barklow, T.; Emma, P.; Krejcik, P.; Walker, N. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Nov 1991. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-9110243-5: 5. International Committee for Future Accelerators (ICFA) beam dynamics workshop, Corpus Christi, TX (United States), 3-8 Oct 1991). Order Number DE92004712. Source: OSTI; NTIS; INIS; GPO Dep.

A technique is described for reconstructing the first order transport matrix (R) for a given beam line. Emphasis is placed on the rigorous error analysis of the data, and the use of powerful statistical techniques to estimate unknown systematic errors. The application of the technique to the measurement and subsequent correction of the SLC Arcs is briefly described. 5 refs., 4 figs.

7287 (SLAC-PUB-5700) **GLAD: A Generic LAttice Debugger.** Lee, M.J. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Nov 1991. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-911116-14: International conference on accelerator and large experimental physics control systems, Tsukuba (Japan), 11-15 Nov 1991). Order Number DE92004949. Source: OSTI; NTIS; INIS; GPO Dep.

Today, numerous simulation and analysis codes exist for the design, commission, and operation of accelerator beam lines. There is a need to develop a common user interface and database link to run these codes interactively. This paper will describe a proposed system, GLAD (Generic LAttice Debugger), to fulfill this need. Specifically, GLAD can be used to find errors in beam lines during commissioning, control beam parameters during operation, and design beam line optics and error correction systems for the next generation of linear accelerators and storage rings.

7288 (SLAC-PUB-5716) **Observation and cures of wakefield effects in the SLC Linac.** Seeman, J.T. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Dec 1991. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-9110243-9: 5. International Committee for Future Accelerators (ICFA) beam dynamics workshop, Corpus Christi, TX (United States), 3-8 Oct 1991). Order Number DE92006432. Source: OSTI; NTIS; INIS; GPO Dep.

The acceleration and transport of beams with high currents and low emittances are very carefully controlled for the SLC Linac. Both longitudinal and transverse wakefields affect strongly the trajectory and emittance corrections used for operations during collisions. Longitudinal beam loading introduces an internal energy spread. This loading produces the expected doubled peaked energy spectra while reducing the overall available energy for acceleration. Transverse wakefields cause rapid oscillation amplitude growth with injection errors but can be ameliorated with transverse wakefield (BNS) damping. Transverse wakefields cause an apparent change in the lattice strength, affecting the interpretation of lattice diagnostics. Oscillations also produce non-gaussian transverse density distributions, which must be controlled for emittance and background reduction. Finally, the small misalignments of the accelerating structure enlarge the emittances of the beam. They can be controlled through off-axis trajectories and through systematic waveguide movements.

4303 Auxiliaries and Components

Refer also to citation(s) 6992, 7202, 7229, 7286, 7385, 7411, 7414, 7417, 7418, 7419, 7420, 7421, 7422, 7423, 7424, 7425, 8198

7289 (ANL/CP-72872) **A shutter design for time domain studies using synchrotron radiation at the advanced photon source.** Norris, J.R.; Bowman, M.K.; Chen, L.; Tang, J.; Thurnauer, M.C.; Knapp, G.S.; Montano, P.A. Argonne National Lab., IL (United States). Sep 1991. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-910730-24: 4. international conference on synchrotron radiation instrumentation, Chester (United Kingdom), 15-19 Jul 1991). Order Number DE92003405. Source: OSTI; NTIS; GPO Dep.

In general a variable repetition rate of the x-ray bunches is needed to explore time domain problems using x-ray radiation. In some instances the results of several hundreds or thousands of x-ray pulses must be averaged requiring the sample to be in the same time dependent state each time the monitoring pulse strikes. In the most advanced and most detailed version of this type experiment an intense laser pulse would be used to create an excited state from a relaxed ground state. An additional "probe-pulse" that follows the laser "pump-pulse" would examine the sample. The important point is that before a second x-ray pulse hits the sample, the system must return to its initial relaxed ground state prior to another laser pulse in order to prepare the same excited state again. Otherwise the second x-ray probes a different condition of the system than the previous x-ray bunch such that any data averaging scheme would be invalid. Our system is primarily designed for the Advanced Photon source (APS) at Argonne National Laboratory. In the 20-bunch mode of APS an x-ray pulse will occur every 177 nanoseconds, requiring each edge of a conventional two-blade "shutter" to travel at least 0.25 mm in ~177 nanoseconds. Our key design principle employs a subsonic, rotating mirror whose period is slaved to the synchrotron intra-pulse period. The synchrotron x-ray bunches will be reflected a distance of about two meters to a narrow 0.5 mm slit just in front of the sample. The time that the reflected synchrotron spends striking the slit is given by $1/(4\pi rf)$ where r is the radius from the center of the spindle to the slit, and f is the frequency of rotation of the spindle. A mirror rotating at a low 7,500 rpm (125 Hz) is sufficient to select a single synchrotron pulse. The very precise phase stability required by this method is currently available in rotating mirror devices for laser scanning. 11 refs., 2 figs.

7290 (ANL/CP–73788) **A high-current, high-voltage power supply with special output current waveform for APS injector synchrotron dipole magnets.** Fathizadeh, M.; Despe, O.D.; McGhee, D.G.; Mills, F.E.; Turner, L.R. Argonne National Lab., IL (United States). [1991]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-911106–41: IEEE nuclear science symposium, Santa Fe, NM (United States), 5-9 Nov 1991). Order Number DE92004132. Source: OSTI; NTIS; INIS; GPO Dep.

This paper describes a high-voltage, high-current power supply for the injector synchrotron dipole magnets at APS. In order to reset the dipole magnets in each cycle two different current waveforms are suggested. The first current waveform consists of three sections, namely: dc-reset, linear ramp, and recovery sections where injection is done "on the fly". The second current waveform consists of six different sections, dc-reset, transition to injection level, injection flat level, parabolic, linear ramp and recovery sections. The effect of such waveforms on the beam is discussed and the power supply limitations to follow such waveforms are given. The power supply limitations are due to the power components and control loops. The reference for the current loop is generated by a DAC which is discussed.

7291 (ANL/CP–74078) **High heat load performance of an inclined crystal monochromator with liquid gallium cooling on the CHESS-ANL undulator.** Macrander, A.T.; Lee, W.K.; Smither, R.K.; Mills, D.M.; Rogers, S.; Khounsary, A. Argonne National Lab., IL (United States). Nov 1991. 28p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-9110146–4: 7. national conference and exhibition on synchrotron radiation instrumentation, Baton Rouge, LA (United States), 28-31 Oct 1991). Order Number DE92004131. Source: OSTI; NTIS; GPO Dep.

Results for the performance of a novel double crystal monochromator subjected to high heat loads from an APS prototype undulator at the Cornell High Energy Synchrotron Source (CHESS) are presented. The monochromator was designed to achieve symmetric diffraction from asymmetric planes to spread out the beam footprint thereby lowering the incident power density. Both crystals had (111) oriented surfaces and were arranged such that the beam was diffracted from the $(11\bar{1})$ planes at 5 KeV. Rocking curves with minimal distortion were obtained at a ring electron current of 96 mA. This corresponded to 370 Watts total power and an peak power density of 48 Watts/mm^2 normal to the incident beam. These results are compared to data obtained from the same crystals in the standard geometry (diffracting planes parallel to surface). The footprint area in the inclined case was three times that of the standard case. We also obtained rocking curve data for the {333} reflection at 15 KeV for both standard and inclined cases, and these data also showed a minimal distortion for the inclined case. In addition, thermal data were obtained via infrared pyrometry. Not only the diffraction data but also the thermal data revealed a dramatically improved performance for the inclined crystal case.

7292 (ANL/CP–74827) **Man-machine interface builders at the Advanced Photon Source.** Anderson, M.D. Argonne National Lab., IL (United States). [1991]. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-911271–1: FedUNIX/Motif '91, Washington, DC (United States), 8-12 Dec 1991). Order Number DE92004716. Source: OSTI; NTIS; INIS; GPO Dep.

Argonne National Laboratory is constructing a 7-GeV Advanced Photon Source for use as a synchrotron radiation source in basic and applied research. The controls and computing environment for this accelerator complex includes graphical operator interfaces to the machine based on Motif, X11, and PHIGS/PEX. Construction and operation of the control system for this accelerator relies upon interactive interface builder and diagram/editor type tools, as well as a run-time environment for the constructed displays which communicate with the physical machine via network connections. This paper discusses our experience with several commercial CUI builders, the inadequacies found in these, motivation for the development of an application- specific builder, and design and implementation strategies employed in the development of our own Man-Machine Interface builder. 5 refs.

7293 (ANL/CP–74843) **First operation of ATLAS using the PII linac and a comparison to tandem injection.** Pardo, R.C.; Bollinger, L.M.; Billquist, P.J.; Bogaty, J.M.; Clifft, B.E.; Markovich, P.; Munson, F.H.; Shepard, K.W.; Zinkann, G.P. Argonne National Lab., IL (United States). [1991]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-9110258–4: Symposium of northeastern accelerator personnel, Albuquerque, NM (United States), 15-19 Oct 1991). Order Number DE92004724. Source: OSTI; NTIS; INIS; GPO Dep.

The ATLAS Positive Ion Injector (PII) is designed to replace the tandem injector for the ATLAS heavy-ion facility. When the PII project is complete, ATLAS will be able to accelerate all ions through uranium to energies above the Coulomb barrier. PII consists of an ECR ion source on a 350 kV platform and a very low-velocity superconducting linac. The PII project is nearing completion. First beam from the complete system is expected in early 1992. Beam tests and experiments using a partially completed PII linac have demonstrated that the technical design goals are being met. The results of the early beam tests and first experiments will be discussed and compared to the performance of ATLAS with tandem injection. 10 refs., 2 figs.

7294 (ANL/CP–74952) **Offset calibration of the beam position monitor using external means.** Chung, Y.; Decker, G. Argonne National Lab., IL (United States). [1991]. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-9110118–4: Accelerator instrumentation workshop, Newport News, VA (United States), 28-31 Oct 1991). Order Number DE92005232. Source: OSTI; NTIS; INIS; GPO Dep.

Determination of the offset of the electrical center of the beam position monitor (BPM) relative to the mechanical center is required for the absolute beam position measurement in the injector synchrotron and the storage ring of the APS. Conventionally, RF signal is sent to an antenna or through a wire carefully aligned in the vacuum chamber and the signal is measured at each electrode. A new method using only external means which does not involve mechanical alignment inside the vacuum chamber was applied to the injector synchrotron BPM unit in this work. The result shows a good agreement with the wire method within 15 μm error. A similar measurement on the storage ring BPM will also be discussed.

7295 (BNL–46121) **Object-oriented programming techniques for the AGS Booster.** Skelly, J.F. Brookhaven National Lab., Upton, NY (United States). [1991]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-911116–15: International conference on accelerator and large experimental physics control systems, Tsukuba (Japan), 11-15 Nov 1991). Order Number DE92005032. Source: OSTI; NTIS; INIS; GPO Dep.

The applications software developed for the control system of the AGS Booster Project was written in the object-oriented language, C++. A the start of the Booster Project, the programming staff of the AGS Controls Section comprised some dozen programmer/analysts, all highly fluent in C but novices in C++. During the coarse of this project, nearly the entire staff converted to using C++ for a large fraction of their assignments. Over 100 C++ software modules are now available for Booster and general AGS use, of which a large fraction are broadly applicable tools. The transition from C to C++ from a managerial perspective is discussed and an overview is provided of the ways in which object classes have been applied in Booster software development.

7296 (BNL–46165) **Photoemission using femtosecond laser pulses.** Srinivasan-Rao, T.; Tsang, T.; Fischer, J. Brookhaven National Lab., Upton, NY (United States). Oct 1991. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-9108118–35: 13. international free-electron laser (FEL) conference, Santa Fe, NM (United States), 25-30 Aug 1991). Order Number DE92004997. Source: OSTI; NTIS; INIS; GPO Dep.

Successful operation of short wavelength FEL requires an electron bunch of current >100 A and normalized emittance < 1 mm-mrad. Recent experiments show that RF guns with photocathodes as the electron source may be the ideal candidate for achieving these parameters. To reduce the emittance growth due to space charge and RF dynamics effects, the gun may have to operate at high field gradient (hence at high RF frequency) and a spot size small compared to the aperture. This may necessitate the laser pulse duration to be in the subpicosecond regime to reduce the energy spread. We will present the behavior of metal photocathodes upon irradiation with femtosecond laser beams, comparison of linear and nonlinear photoemission, and scalability to high currents. Theoretical estimate of the intrinsic emittance at the photocathode in the presence of the anomalous heating of the electrons, and the tolerance on the surface roughness of the cathode material will be discussed.

7297 (BNL–46679) **Performance of the Brookhaven photocathode rf gun.** Batchelor, K. (Brookhaven National Lab., Upton, NY (United States)); Ben-Zvi, I.; Fernow, R.C.; Fischer, J.; Fisher, A.S.; Gallardo, J.; Ingold, G.; Kirk, H.G.; Leung, K.P.; Malone, R.; Pogorelsky, I.; Srinivasan-Rao, T.; Rogers, J.; Tsang, T.; Sheehan, J.Brookhaven National Lab., Upton, NY (United States). [1991]. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-9108118–38: 13. international free-electron laser (FEL) conference, Santa Fe, NM (United States), 25-30 Aug 1991). Order Number DE92005008. Source: OSTI; NTIS; INIS; GPO Dep.

The Brookhaven Accelerator Test Facility (ATF) uses a photocathode rf gun to provide a high-brightness electron beam intended for FEL and laser-acceleration experiments. The rf gun consists of $1\frac{1}{2}$ cells driven at 2856 MHz in π-mode with a maximum cathode field of 100 MV/m. To achieve long lifetimes, the photocathode development concentrates on robust metals such as copper, yttrium and samarium. We illuminate these cathodes with a 10-ps, frequency-quadrupled Nd:YAG laser. We describe the initial operation of the gun, including measurements of transverse and longitudinal emittance, quantum efficiencies, and peak current. The results are compared to models.

7298 (BNL–46750) **What's new with FASTBUS and what's it done in the particle accelerator laboratories.** Costrell, L. (National Inst. of Standards and Technology, Gaithersburg, MD (United States)); Dawson, W.K.; Ponting, P.J.; Platner, E.D.; Paffrath, L.; Barsotti, E.J.; Downing, R.W. Brookhaven National Lab., Upton, NY (United States). [1991]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-911106–53: IEEE nuclear science symposium, Santa Fe, NM (United States), 5-9 Nov 1991). Order Number DE92005002. Source: OSTI; NTIS; INIS; GPO Dep.

The FASTBUS modular high-speed data acquisition and control system has been described in earlier papers. Implementations have since been made in accelerator laboratories world-wide resulting in clarifications, modifications and extensions. Of tremendous benefit to users have been FASTBUS Standard Routines. The availability of such standard software is unique for high speed bus systems and resulted from the involvement of hardware and software specialists in all aspects of the development. FASTBUS is the highest performance instrumentation and data acquisition bus in existence and its development was essential to handle the outputs of detectors used with high energy accelerators now in operation. It has been an important factor in recent experiments, including the Z^0 measurements at CERN, Fermilab and SLAC. Also among numerous FASTBUS implementations are those for TPC systems at KEK and BNL. 2 refs., 5 figs.

7299 (BNL–46773) **Beam instrumentation in the AGS Booster.** Witkover, R.L. Brookhaven National Lab., Upton, NY (United States). [1991]. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-9110118–2: Accelerator instrumentation workshop, Newport News, VA (United States), 28-31 Oct 1991). Order Number DE92004999. Source: OSTI; NTIS; INIS; GPO Dep.

The AGS Booster was designed to accelerate low intensity (2×10^{10}) polarized protons, high intensity (1.5×10^{13}) protons and heavy ions through Au^{+33}. Coping with this wide range of beams, the 3×10^{-11} Torr vacuum and the radiation environment presented challenges for the beam monitors. Some of the more interesting instrumentation design and performance during the recent Booster proton commissioning will be described.

7300 (BNL–46794) **Analysis of a high brightness photo electron beam with self field and wake field effects.** Parsa, Z. Brookhaven National Lab., Upton, NY (United States). [1991]. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-9108118–39: 13. international free-electron laser (FEL) conference, Santa Fe, NM (United States), 25-30 Aug 1991). Order Number DE92004983. Source: OSTI; NTIS; INIS; GPO Dep.

High brightness sources are the basic ingredients in the new accelerator developments such as Free-Electron Laser experiments. The effects of the interactions between the highly charged particles and the fields in the accelerating structure, e.g. R.F., Space charge and Wake fields can be detrimental to the beam and the experiments. We present and discuss the formulation used, some simulation and results for the Brookhaven National Laboratory high brightness beam that illustrates effects of the accelerating field, space charge forces (e.g. due to self field of the bunch), and the wake field (e.g. arising from the interaction of the cavity surface and the self field of the bunch).

7301 (BNL–46795) **Effects of variation of the laser pulse width on the laser induced photoelectrons.** Parsa, Z. Brookhaven National Lab., Upton, NY (United States). [1991]. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-9108118–40: 13. international free-electron laser (FEL) conference, Santa Fe, NM (United States), 25-30 Aug 1991). Order Number DE92004984. Source: OSTI; NTIS; INIS; GPO Dep.

The effects of the variation of the Laser pulse width on the laser induced photoelectrons, from the BNL gun is presented, including the variation in the emittance of the beam, which is crucial to the operation of a Free Electron Laser (FEL). The radio-frequency (RF) electron gun with a photocathode in the end wall of an RF cavity is excited by a laser pulse that is synchronized with the RF, is powered by a conventional type SLAC klystron, and is designed to produce a low emittance beam of 4.65 MeV at the gun exit with the field gradient of 100 MV/m on the Cathode.

7302 (BNL–46827) **Design and operation of the AGS Booster Ionization Profile Monitor.** Stillman, A.N.; Thern, R.E.; Van Zwienen, W.H.; Witkover, R.L. Brookhaven National Lab., Upton, NY (United States). [1991]. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-9110118–3: Accelerator instrumentation workshop, Newport News, VA (United States), 28-31 Oct 1991). Order Number DE92004987. Source: OSTI; NTIS; INIS; GPO Dep.

The AGS Booster Ionization Profile Monitor (IPM) must operate in a vacuum of about 3×10^{-11} Torr. The ultra-high vacuum imposes certain requirements on detector gain and restrictions on construction techniques. Each detector is a two-stage micro-channel plate with an integral substrate containing sixty-four printed anodes. Formed electrodes provide uniform collection fields without the use of resistors, which would be unacceptable in these vacuum conditions. An ultra-violet light calibrates the detector in its permanent mounting. An extra set of electrodes performs a first order correction to the perturbations imposed by the horizontal and vertical collection electrodes. This paper will present details of the design of the profile monitor and recent operational results. 4 refs., 6 figs.

7303 (BONN-IR–91-33) **Construction and test of a source of polarized electron beams for the injection into the Bonn accelerator facility ELSA.** Voigt, S. Bonn Univ. (Germany). Physikalisches Inst.; Bonn Univ. (Germany). Mathematisch-Naturwissenschaftliche Fakultaet. Jun 1991. 43p. (In German). Order Number DE92758863. Source: OSTI; NTIS (US Sales Only); INIS.

The construction and test of a source of polarized electrons is described. The electrons are produced by photoemission with circular polarized Laser light on a GaAs-crystal. The electron beam is accelerated up to an energy of 120 keV which is adapted to the injection energy into the Linac. A spin rotator changes the spin vectors from longitudinal to transversal orientation. The spin rotation is a necessary condition for the further acceleration in the 2.5 GeV-Synchrotron and in ELSA. For the measurement of the polarization degree Mott-scattering on a thin gold target is used. A polarization degree of 30% has been measured. (orig.).

7304 (DOE/ER/40527–T2) **Theoretical problems in accelerator physics: Progress report.** California Univ., San Diego, La Jolla, CA (United States). Dept. of Physics. [1991]. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract AS03-89ER40527. Order Number DE92003774. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses research in the following areas of accelerator physics: analysis and design of rf cavities; and rf power sources. (LSP)

7305 (FNAL/C–91/204) **Magnet end design: The main injector dipoles.** Ostiguy, J.F. Fermi National Accelerator Lab., Batavia, IL (United States). Aug 1991. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-910505–429: 1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC), San Francisco, CA (United States), 6-11 May 1991). Order Number DE92005109. Source: OSTI; NTIS; INIS; GPO Dep.

From the accelerator designer standpoint, one of the quantities of interest in a magnet is the axially integrated transverse field. It is easily shown that the latter satisfies the equations of 2D magnetostatics. This is the basic theoretical result needed to design accelerator magnet ends. Unfortunately, axially integrated fields must be obtained from accurate 3D field maps and magnets ends have historically been designed using a cut and try approach. To a certain extent, this remains true even today; however, the advent of reliable 3D magnet design codes now permits to substantially reduce the costs associated with the construction of various prototypes. In this paper, the theory of magnet end design is reviewed. The design of the end of the dipole magnets of the proposed Fermilab Main Injector is analyzed in a detailed manner using TOSCA, a well-established 3D finite element code. Provided the limitations of the code are well understood by the user, the integrated field profile is satisfactorily predicted.

7306 (FNAL/C–91/218) **An overview of the multilayer insulation system for the Superconducting Super Collider.** Boroski, W.; Nicol, T.; Schoo, C.J. Fermi National Accelerator Lab., Batavia, IL (United States). Aug 1991. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (SSCL–503;CONF-910803–6: International congress on refrigeration: new challenges in refrigeration, Montreal (Canada), 10-17 Aug 1991). Order Number DE92005108. Source: OSTI; NTIS; INIS; GPO Dep.

The MLI system for the SSC is designed to meet strict performance requirements over the 25 year life of the accelerator. Thermal measurements at 80K and 20K have been used to create an MLI system that limits heat flow to design values while incorporating features that permit the use of large-scale fabrication techniques. The result is a cost-effective means of mass-producing MLI blankets of consistent geometry and thermal performance.

7307 (FNAL/C–91/246) **Test results from Fermilab 1.5 m model SSC collider dipole magnets.** Koska, W.; Bossert, R.; Carson, J.; Coulter, K.J.; Delchamps, S.; Gourlay, S.; Jaffery, T.S.; Kinney, W.; Lamm, M.J.; Ozelis, J.P.; Strait, J.; Wake, M. Fermi National Accelerator Lab., Batavia, IL (United States). Sep 1991. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-910881–29: Particles and fields '91, Vancouver (Canada), 18-22 Aug 1991). Order Number DE92004531. Source: OSTI; NTIS; INIS; GPO Dep.

We will present results from tests of 1.5 m model SSC collider dipole magnets. These R&D magnets are identical to the 15 m full length dipoles currently being assembled at Fermilab in all important aspects except length. Because of their small size they can be built faster and tested more extensively than the long magnets. The model magnets are used to optimize design parameters for, and to indicate the performance which can be expected from, the 15 m magnets. The are instrumented with voltage taps over the first two current blocks for quench localization and with several arrays of strain gauge transducers for the study of mechanical behavior. The stress at the poles of the inner and outer coils is monitored during construction and, along with end force and shell strain, during excitation. Magnetic measurements are made several times during each magnet's lifetime, including at operating temperature and field. We will report on studies of the quench performance, mechanical behavior and magnetic field of these magnets.

7308 (FNAL/C–91/254) **Magnetic field measurements of 1.5 meter model SSC collider dipole magnets at Fermilab.** Lamm, M.J. (Fermi National Accelerator Lab., Batavia, IL (United States)); Bleadon, M.; Coulter, K.J.; Delchamps, S.; Hanft, R.; Jaffery, T.S.; Kinney, W.; Koska, W.; Ozelis, J.P.; Strait, J.; Wake, M.; DiMarco, J. Fermi National Accelerator Lab., Batavia, IL (United States). Sep 1991. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (SSCL–541;CONF-910662–16: 12. international conference on magnet technology, Leningrad (USSR), 23-28 Jun 1991). Order Number DE92004530. Source: OSTI; NTIS; INIS; GPO Dep.

Magnetic field measurements have been performed at Fermilab on 1.5 m magnetic length model dipoles for the Superconducting Supercollider. Harmonic measurements are recorded at room temperature before and after the collared coil is assembled into the yoke and at liquid helium temperature. Measurements are made as a function of longitudinal position and excitation current. High field data are compared with room temperature measurements of both the collared coil and the completed yoked magnet and with the predicted fields for both the body of the magnet and the coil ends.

7309 (FNAL/C–91/255) **Mechanical behavior of Fermilab-built 1.5 m model SSC collider dipoles.** Strait, J. (Fermi National Accelerator Lab., Batavia, IL (United States)); Bossert, R.; Carson, J.; Coulter, K.J.; Delchamps, S.; Jaffery, T.S.; Kinney, W.; Koska, W.; Gourlay, S.; Lamm, M.J.; Wake, M.; Sims, R.; Winters, M. Fermi National Accelerator Lab., Batavia, IL (United States). Sep 1991. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (SSCL–542;CONF-910662–14: 12. international conference on magnet technology, Leningrad (USSR), 23-28 Jun 1991). Order Number DE92004529. Source: OSTI; NTIS; INIS; GPO Dep.

Several model SSC collider dipole magnets (50 mm aperture, 1.5 m magnetic length) have been built and tested at Fermilab. These magnets are instrumented with strain gauges to measure stresses in the coil, the cold mass shell, and the coil end clamp assembly. Measurements are made of these quantities during assembly, cooldown, excitation, and warmup. Additional mechanical measurements are made on magnet sub-assemblies during manufacturing. Data from these measurements are presented and compared with expectations from the design calculations.

7310 (FNAL/C–91/257) **Quench behavior of 1.5 m model SSC collider dipole magnets at Fermilab.** Wake, M. (Fermi National Accelerator Lab., Batavia, IL (United States)); Bossert, R.; Carson, J.; Coulter, K.; Delchamps, S.; Gourlay, S.; Jaffery, T.S.; Kinney, W.; Koska, W.; Lamm, M.J.; Strait, J.; Sims, R.; Winters, M. Fermi National Accelerator Lab., Batavia, IL (United States). Sep 1991. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-910662–15: 12. international conference on magnet technology, Leningrad (USSR), 23-28 Jun 1991). Order Number DE92004528. Source: OSTI; NTIS; INIS; GPO Dep.

The quench behaviors of 10 model dipole magnets for the Superconducting Super Collider have been studied. Horizontally split yoke, vertically split yoke and the latest 50 mm diameter design were compared in the quench characteristics. The excitation results showed a good progress of the R&D program. SSC magnets can now be built with no training to the required field of 6.65 T at 4.3 K.

7311 (FNAL/C–91/311) **A TRD Trigger for the tevatron collider experiment at D0.** Utes, M.; Johnson, M.; Martin, M. Fermi National Accelerator Lab., Batavia, IL (United States). Nov 1991. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-911106–40: IEEE nuclear science symposium, Santa Fe, NM (United States), 5-9 Nov 1991). Order Number DE92004118. Source: OSTI; NTIS; INIS; GPO Dep.

A VME-based module for use as an input to the D0 Detector Level 1.5 Trigger is described. Its main function will be the confirmation of electron candidates flagged by the First Level Calorimeter

Trigger using digitized data from the Transition Radiation Detector. Features of the board include the use of fast FIFOs to store incoming track coordinates, dual ported SRAM lookup tables for addressing integrated charge data and forming scalars, multiplier/accumulators for speed of calculation, and a single synchronous finite state machine to control all board operations. 4 refs., 3 figs.

7312 (FNAL-TM–1726) **The effect of particulate debris on the insulation integrity of SSC coils during molding and collaring.** Nehrlich, E.; Markley, F.; Rogers, D. Fermi National Accelerator Lab., Batavia, IL (United States). Mar 1991. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-910340–51: 3. annual international industrialization symposium on the super collider (IISSC), Atlanta, GA (United States), 13-15 Mar 1991). Order Number DE92003885. Source: OSTI; NTIS; INIS; GPO Dep.

In order to simulate the effect of accidentally introduced debris on SSC coil insulation integrity, models consisting of two pieces of insulated SSC cable have been loaded in an hydraulic press after introducing foreign particles between the layers. The tests were originally suggested by R. Palmer of the SSC Laboratory. A high voltage (2 Kv) was continually applied between the two cables and the load gradually increased until an electrical short occurred. The high voltage was used as an easy method of detecting insulation punctures and to continue the general type of testing begun at Brookhaven by J. Skaritka, now at the SSC Laboratory, and continued at Fermilab by F. Markley and presented at last year's session of the Conference. A range of particles of different size, shape, and hardness were used, and both conducting and insulating particles were included. Fine wires were also used. When the data are normalized using the control (no particles added), data for each cable batch used, there is a slight correlation between pressure at breakdown and particle size for cables insulated with Kapton only. Adjustment must be made for soft particles that tend to deform and for particles with aspect ratios greater than one. Additional measurements have also been made where the opoxy-fiberglass layer was added to the Kapton insulation overwrap. These show a correlation between conductivity and breakdown pressure. 1 ref., 7 figs.

7313 (FNAL-TM–1728) **Stress relaxation in SSC collared coils and their component materials.** Markley, F.; Corpus, O.; Herdt, B.; Lautenschlager, A.; Rogers, D.; Stadtler, L. Fermi National Accelerator Lab., Batavia, IL (United States). Mar 1991. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-910340–52: 3. annual International Industrialization Symposium on the Super Collider (IISSC), Atlanta, GA (United States), 13-15 Mar 1991). Order Number DE92004676. Source: OSTI; NTIS; INIS; GPO Dep.

Previous work, reported at last year's meeting, has been continued. One model section of an SSC outer coil has had it's stress relaxation measured for nearly two years. In addition, the stress relaxation of SSC cable without insulation has been measured. Kapton insulation alone has been studied both in creep and stress relaxation. Creep has been measured parallel to the plane of the film. These measurements are dependent on internal stresses that may be present in the film and on the moisture content of the film. They indicate that any measurements of coil relaxation are not likely to be repeatable if these factors are not controlled. The measurements on Kapton film alone are being done at different temperatures to obtain a time-temperature shift factor so that measurements at one temperature may be used to predict relaxation at any other temperature. 12 refs., 8 figs.

7314 (FNAL-TM–1761) **T839 fiber tracking transporter at New Muon Lab.** Krider, J. Fermi National Accelerator Lab., Batavia, IL (United States). 23 Oct 1991. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. Order Number DE92003899. Source: OSTI; NTIS; INIS; GPO Dep.

A darkbox and its transporter have been designed for T839 fiber tracking tests. The darkbox is 3.35 m x 0.76 m x 0.25 m (1·w·h) and contains a scintillating fiber ribbon suspension system and mechanical hardware to support the readout electronics. The transporter provides 3.0 m of horizontal motion transverse to the beam for linear scans of fiber characteristics. In addition, 70 degrees of rotation about a vertical axis is provided to simulate tracking of particles emanating from a collision point at lab angles in the range 0°–70°. The transporter, which is located inside a radiation area, is remotely controlled to permit scanning the fiber array through the region defined by four small stationary triggering scintillators without disabling beam. The transporter rails extend 20 feet to the west beyond a gate in the radiation enclosure fencing. This provides a staging area to work on the apparatus, while the beam is on. 4 figs.

7315 (INFN-TC–89-12) **Analog control loops for the Milan K800 cyclotron RF system.** Bosotti, A. (Istituto Nazionale di Fisica Nucleare, Milan (Italy)); Pagani, C.; Di Giacomo, M.; Gallo, A. Istituto Nazionale di Fisica Nucleare, Rome (Italy). 1989. 16p. Order Number DE92612846. Source: OSTI; NTIS (US Sales Only); INIS.

In this paper the desing criteria and the main features of the two analog feedback loops which are used to control the phase and the amplitude stability of the Milan Superconducting Cyclotron accelerating voltage are described, together with the resonator fine tuning system. The experimental results, obtained during the full power tests of the first RF cavity, are also presented. A phase stability better than ±0.2 grade centigrades and an amplitude modulation noise below $5 \cdot 10^{-5}$ at 100 kV peak dee voltage were routinely achieved all over the frequency range (15/48 MHz).

7316 (INIS-mf–13026, pp. 291-292) **First experimental results from the high current ion source.** Thakur, N.M. (Bhabha Atomic Research Centre, Bombay (India). Nuclear Physics Div.); Sethi, R.C. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. DUOPLASMATRONS/magnetic fields; BEAM CURRENTS; DUOPLASMATRONS; ELECTRIC ARCS; ELECTRIC POTENTIAL; ELECTRON EMISSION; FILAMENTS; KEV RANGE 10-100; PERFORMANCE; PRESSURE DEPENDENCE

7317 (INIS-mf–13026, pp. 295-296) **Status of ISOL facility at VECC.** Chakrabarti, A. (Variable Energy Cyclotron Centre, Calcutta (India)); Bandyopadhyay, A.; Bandyopadhyay, Arup; Basu, S.K.; Bhattacharya, N.C.; Chattopadhyay, S.; Mazumder, M.D.; Mukhopadhyay, T.; Poley, A.; Mazumdar, A.K. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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7318 (INIS-mf–13026, pp. 299-300) **Studies on narrowing of time profile of a cyclotron beam by shaping the slit of the ion source.** Sarma, P.R. (Variable Energy Cyclotron Centre, Calcutta (India)). Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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7319 (INIS-mf–13026, pp. 293-294) **Development and progress in the deuteron RFQ.** Sethi, R.C. (Bhabha Atomic Research Centre, Bombay (India). Nuclear Physics Div.); Nimje, V.T.; Thakur, N.M.; Kapoor, S.S. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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BEAM CURRENTS; BEAM DYNAMICS; BEAM PROFILES; BEAM SHAPING; KEV RANGE 100-1000; SPECIFICATIONS

7320 (INIS-mf–13026, pp. 305-306) **PC-Horizon based data acquisition system with Ethernet link.** Chatterjee, A. (Bhabha Atomic Research Centre, Bombay (India). Nuclear Physics Div.); Kumar, Vineet; Mohanty, A.K.; Nayak, B.K.; Kumar, Surendra. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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7321 (INIS-mf–13026, pp. 307-308) **PDP-11/23 and Starburst based multiparameter data acquisition system.** Saxena, Alok (Bhabha Atomic Research Centre, Bombay (India). Nuclear Physics Div.); Kumar, Surendra; Mohanty, A.K.; Kataria, S.K. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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7322 (INIS-mf–13026, pp. 309-310) **A ND-100 based data acquisition facility at VECC.** Roy, A. (Variable Energy Cyclotron Centre, Calcutta (India)); Dasgupta, P.K.; Bandyopadhyay, A.; De, S.K. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CALCUTTA CYCLOTRON/data acquisition systems; CAMAC SYSTEM; DATA ACQUISITION; DATA TRANSMISSION; NORD COMPUTERS; REAL TIME SYSTEMS

7323 (INIS-mf–13026, pp. 311-312) **Location of magnetic centre in multipole fields by optical method.** Rashid, M.H. (Variable Energy Cyclotron Centre, Calcutta (India)); Mallik, C.; Mukhopadhyay, N.K.; Rodrigues, G. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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7324 (INIS-mf–13026, pp. 319-320) **A post-accelerator foil stripper for the BARC-TIFR pelletron facility.** Narvekar, S.D. (Tata Inst. of Fundamental Research, Bombay (India)); Hosangadi, R.R.; Tribedi, L.C.; Pillay, R.G.; Prasad, K.G.; Tandon, P.N. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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7325 (INIS-mf–13026, pp. 323-324) **Automation of double axis goniometer for channeling/blocking measurements.** Nanal, V.S. (Tata Inst. of Fundamental Research, Bombay (India)); Fernandes, W.A.; Kurup, M.B.; Prasad, K.G. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CHARGED PARTICLES/channeling; GONIOMETERS/automation; GONIOMETERS/channeling; GONIOMETERS/equipment interfaces; CHANNELING; DATA ACQUISITION; GONIOMETERS; AUTOMATION; MICROPROCESSORS; MOTION; MOTORS; PELLETRON ACCELERATORS; ROTATION

7326 (INIS-mf–13026, pp. 321-322) **Triple axes multiple target holder assembly.** Tribedi, L.C. (Tata Inst. of Fundamental Research, Bombay (India)); Narvekar, S.D.; Pillay, R.G.; Tandon, P.N. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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7327 (JAERI-M–91-141) **Proceedings of the Tokyo international symposium '90 on free electron lasers.** Japan Atomic Energy Research Inst., Tokyo (Japan). Sep 1991. 148p. (CONF-900168–: JAERI free electron symposium, Tokyo (Japan), 29-30 Jan 1990). Order Number DE92751037. Source: OSTI; NTIS (US Sales Only); INIS.

This issue is the collection of the papers presented at the title meeting. The 18 of the presented papers are indexed individually. (J.P.N.).

7328 (JHP–17) **Brief report of the design work on buildings of the Japanese Hadron Project, 1.** Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Apr 1991. 32p. (In Japanese). Order Number DE92751042. Source: OSTI; NTIS (US Sales Only); INIS.

A brief report of the design work on buildings of the Japanese Hadron Project has been published as a JHP-report (JHP-15). The design of the buildings has to be modified to fulfill the detailed design works on accelerators and experimental facilities which are in still progress. Modification of drawings ie easy if they are prepared as data in a CAD system. Most of the drawings have therefore been newly prepared as data in the CAD system. Some of the drawings in JHP-15 have been modified to meet the recent study of the beam line optics requirements for the JHP beam line. The CAD system used is MiniCad+ by GRAPHSOFT INC. Data of drawings in 3.5 inch floppy disks can be distributed. (author).

7329 (JHP–18) **Report of the workshop on the radiation safety system for the high-intensity high-energy accelerator facility.** Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Jun 1991. 128p. (In Japanese). Order Number DE92751043. Source: OSTI; NTIS (US Sales Only); INIS.

A workshop on the radiation safety system for the high-intensity high-energy accelerator facility was held to discuss variety of subjects related to the radiation safety system for the accelerator facility. As several large accelerator facilities are now under construction; a ring cyclotron (RCNP, Osaka Univ.), a cyclotron of the Ion-Beam Facility (JAERI-TRCRE), a heavy-ion synchrotron (National Institute of Radiological Sciences), and a large synchrotron radiation facility (SPring-8), and high-intensity high-energy accelerator facilities are now being planned; JHP (INS, Univ. of Tokyo), high-intensity linear accelerator complex (JAERI, Tokai R.E.), and high-intensity electron accelerator complex (PNC, Tokai), it is a good chance to have a workshop to discuss with those who are working for the design of the radiation safety system for these facilities. The subjects discussed were shielding calculations, experiments on shielding, development of high-intensity beam line components, radiation control at the high-intensity beam facility, monitoring system, and design of shielding for accelerator facilities. (author).

7330 (KEK–90-25(v.1), pp. 32-40) **LANSCE '90: the Manuel Lujan Jr. Neutron Scattering Center.** Pynn, Roger (Los Alamos National Lab., NM (United States)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

This paper describes progress that has been made at the Manuel Lujan Jr. Neutron Scattering Center (LANSCE) during the past two years. Presently, LANSCE provides a higher peak neutron flux than any other pulsed spallation neutron source. There are seven spectrometers for neutron scattering experiments that are operated for a national user program sponsored by the U.S. Department of Energy. Two more spectrometers are under construction. Plans have been made to raise the number of beam holes available for instrumentation and to improve the efficiency of the target/moderator system. (author).

7331 (KEK–90-25(v.1), pp. 119-133) **Enriched vs non-enriched vs non-fissile targets for pulsed spallation neutron sources.** Carpenter, J.M. (Argonne National Lab., IL (United-States)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

Numerous options exist among alternatives for target material and design of the neutron producing target in pulsed spallation neutron sources. This report surveys the advantages, disadvantages and limitations of some of the alternatives, including discussions of neutron yields, delayed neutron backgrounds, source pulse widths, source-to-moderator coupling, materials performance, fabrication problems, safeguards and security and hazards questions. (author).

7332 (KEK–90-25(v.1), pp. 190-193) **Accelerator aspects of the ISIS upgrade.** Gardner, I.S.K. (Rutherford Appleton Lab., Chilton (United Kingdom)); Rees, G.H. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

A brief account is given of the future plans to attempt to increase the intensity of the ISIS proton beam. (author).

7333 (KEK–90-25(v.1), pp. 194-198) **INR linear accelerator and the compressor ring project for the neutron spallation sources.** Esin, S.K. (AN SSSR, Moscow (USSR). Inst. Yadernykh Issledovanij); Grachev, M.I.; Fedotov, A.P. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

Status of the INR linear accelerator, the proton storage ring as a compressor ring of the Moscow meson factory are discussed. (author).

7334 (KEK–90-25(v.1), pp. 218-223) **High-power 'Regotron'-type microwave generator for intensive technological accelerators.** Batskikh, G.I. (AN SSSR, Moscow (USSR). Radiotekhnicheskij Inst.); Murin, B.P.; Durkin, A.P.; Shlygin, O.Yu.; Shumakov, I.V. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

Theoretical principles and the construction scheme of the super-power microwave relativistic electron beam (REB) 'Regotron'-type generator are presented. The generator is supposed to be used for the accelerating cavities power supply of the intensive accelerator. To increase the device efficiency the autophasing-principle is used. The regotron efficiency can reach 70...80% with output power up to 5...10 MW in the continuous mode. (author).

7335 (KEK–90-25(v.1), pp. 224-234) **Treatment of H^0 and H^- beams spilled at the stripper foil at full energy charge-exchange injection scheme.** Yamane, Isao (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

The charge-exchange injection into a synchrotron to generate high-intensity pulsed proton beams for a spallation neutron source is reviewed while focusing on the treatment of H^0 and H^- beams spilled at the stripper foil. After charge-exchange injection is briefly outlined, scattering by foil atoms and causes to spill H^0 and H^- beams are described. These spilled beams can amount to several μA and should be carefully treated. It is then shown that a direct H^- injection system needs to be considerably long and requires a very long straight section. Because of its simplicity, two-step H^0 injection has very wide applicability to various types of rings. However, it has a problem of emittance growth due to angular divergence in the stripper magnet and an ionoptical mismatch at the stripper foil. These problems are discussed, including a new proposal for a measure to remedy this problem. The laser photoionization injection is also briefly mentioned. (author).

7336 (KEK–90-25(v.1), pp. 235-241) **Perfect matching for two-step H^0 injection into a ring with a DBFO lattice and minimization of the overall emittance growth.** Yamane, Isao (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

A procedure is given for achieving perfect matching in two-step H^0 injection into a DBFO lattice. It is at first shown that the foil should be located between B and F and the stripper magnet should be set so that the bending plane is vertical in order to make the H^0 beam match the ring optics. Then, the Twiss parameters of the H^- beam are determined so as to be converted to those of the H^0 beam which matches the ring optics through the charge-exchange process in the stripper magnet. It is shown that, though perfect matching at the foil can be achieved, the emittance growth in the stripper magnet can not be made to completely disappear. A factor K is defined as a measure of the emittance growth in the stripper magnet. When C is the mismatch factor at the foil, (KxC) is a measure of the total emittance growth during the entire charge-exchange process. The (KxC) factor should be minimized in an actual application, resulting that a small K as well as a small C will remain. (author).

7337 (KEK–90-25(v.1), pp. 242-246) **System for generating double-pulsed magnetic fields in a kicker magnet.** Kawakubo, Tadamichi (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)); Tazawa, Sichiro; Arakida, Yosio; Murasugi, Sigeru. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

Two bunched beams are accelerated in the 1A ring of JHF. They are extracted for meson experiments and for neutron experiments successively. Therefore, the extraction kicker magnet should generate double-pulsed magnetic fields at intervals of about 100 μsec, with a repetition rate of 50 Hz. In order to test the feasibility of generating double pulses, we used two sets of thyratron housings and a kicker magnet for the KEK-PS-extraction system, which has an impedance of 25 Ω. Using a thyratron cathode-loaded system, the first firing induces a second misfire by a rapid voltage drop of the second thyratron cathode. A thyratron anode-loaded system does not have the above-mentioned trouble, and has succeeded in generating the desired double pulses with half of the voltage required for the usual operation of JHF (≈ 80kV). (author).

7338 (KEK–90-25(v.1), pp. 251-258) **Present status of the test rf system for the KEK PS Booster.** Ninomiya, S. (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)); Takano, S.; Yoshii, Y.; Toda, M.; Katori, T. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

Since 1988 we have been constructing a new accelerating system for the KEK PS Booster. The system cancels the beam loading effect. The system test operation result is reported. Our analysis on the beam loading effect is also described. (author).

7339 (KEK–90-25(v.1), pp. 262-269) **Experimental RF proton accelerator with superconducting solenoid beam focusing.** Bondarev, B.I. (AN SSSR, Moscow (USSR). Radiotekhnicheskij Inst.); Griasnov, N.A.; Keilin, V.E. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

Theoretical and applied aspects of a beam current increase in ion linacs by using superconducting solenoid focusing are considered. Results of the SIU-1 experimental RF proton accelerator development and testing are presented. The main accelerator parameter are : the 1.5 MeV energy, the 1.75 MeV/m accelerating rate, the 200 MHz operating frequency. (author).

7340 (KEK–90-25(v.1), pp. 270-278) **Particle tracking in the BSF beamline.** Adachi, T. (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

A particle-tracking program for transverse motion was developed. It is used to calculate the particle trajectory affected by dipole and quadrupole magnetic fields. The calculation also considers multiple Coulomb scattering and energy loss in matter. The program was applied to a transport line for a 500-MeV proton beam. The result was compared with beam profiles and residual radioactivities measured along the beamline. (author).

7341 (KEK–90-25(v.1), pp. 319-334) **The neutronic performance of solid-target alternatives for SINQ.** Atchison, F. (Paul Scherrer Inst. (PSI), Villigen (Switzerland)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

The results from calculations of the neutronic performance of three possible 'solid' targets and that of the current version of the liquid Pb-Bi target are presented. Two are 'conventional' transverse cooled plate structures, one using tantalum, the other tungsten. The third is a Pb-shot based pebble-bed design. Some general results on the effect of neutron absorption on the performance of the Pebble-bed target are given. (author).

7342 (KEK–90-25(v.1), pp. 335-339) **Split-target neutronics.** Russell, G.J. (Los Alamos National Lab., NM (United States)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

Monte Carlo simulations show that, for the LANSCE split-target of machineable tungsten, about 60% of the low-energy (<20 MeV) neutron leakage from the target comes from primary (800-MeV) proton interactions. The remaining 40% occurs from secondary high-energy reactions in the split-target. Primary protons are forward directed; secondary high-energy (>20 MeV) particles are also forward directed. Consequently, the neutronic performance of the LANSCE Target-Moderator-Reflector-Shield (TMRS) system is not adversely impacted by employing a split-target. Implementing a split-target allows us to use flux-trap moderators around the void zone between the targets to simultaneously service twelve neutron flight paths. (author).

7343 (KEK–90-25(v.1), pp. 340-353) **Neutron emission from an extended lead target under the action of light ions in the GeV region.** Vassil'kov, R.G. (AN SSSR, Moscow (USSR). Radiotekhnicheskij Inst.); Yurevich, V.I. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

Experimental data are presented on yields and spectra of neutrons, emitted from a lead cylinder ϕ20 x 60 cm, bombarded by beams of p, d, ^{3}He, ^{4}He, ^{12}C with energies 1-7, 3 GeV per unit of ion charge. Measurements have been carried out by the neutron moderation technique and with solid state nuclear track detectors (SSNTD). The results obtained will be used as a scientific base for the power accelerator-based neutron sources. (author).

7344 (KEK–90-25(v.1), pp. 369-375) **Shutter system for the SINQ neutron guides.** Anderson, I. (Paul Scherrer Inst. (PSI), Villigen (Switzerland)); Ehrat, J.; Suhi, D.; Wagner, W. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

Viewing the liquid D_2 cold moderator of the spallation source SINQ, a neutron guide system will be provided to achieve an efficient transport of subthermal neutrons to the instruments in the remote experimental hall. Four separate neutron guides are forseen, with an option for a fifth one to be installed in future. The concept of guide shielding and performance includes a set of shutters, situated at the outside of the main target shielding, with the dual purpose of shielding the radiation from the target and inner shielding in the closed position and guiding the neutron beam in the open position. This latter function imposes strict requirements on alignment accuracy and mechanical stability while the necessity of shielding high energy neutrons from the spallation target implies the use of bulky shielding. The technical concept elaborated to fulfill these requirements is presented. (author).

7345 (KEK–90-25(v.1), pp. 379-387) **Recent experience with IPNS moderators.** Carpenter, J.M. (Argonne National Lab., IL (United States)); Scott, T.L. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

We describe experience with the moderators of IPNS in the two years since the installation of the Enriched Uranium Booster Target. (author).

7346 (KEK–90-25(v.1), pp. 388-400) **Optimization studies on coupled liquid hydrogen moderator.** Kiyanagi, Y. (Hokkaido Univ., Sapporo (Japan). Faculty of Engineering); Iwasa, H.; Fujikawa, I.; Watanabe, N.; Furusaka, M. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

Optimization studies on a coupled liquid-hydrogen-moderator system were performed experimentally and the results were compared with those of decoupled liquid hydrogen and solid methane moderators. A very high gain factor is obtained. Pulse characteristics were also studied and it is found that the pulse broadening by coupling is rather modest. (author).

7347 (KEK–90-25(v.1), pp. 401-407) **Reflector optimization for coupled liquid hydrogen moderator.** Kiyanagi, Y. (Hokkaido Univ., Sapporo (Japan). Faculty of Engineering); Iwasa, H.; Watanabe, N.; Furusaka, M. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

As a part of optimization studies on a coupled liquid hydrogen moderator system, the optimal thickness of the reflector, the effects of neutron absorbing liners and other beam hole/moderator on the cold-neutron-beam intensity were studied experimentally. It turns out that the optimal thickness is rather thick in this system and the existence of Cd liners around the beam extraction hole considerably reduces the cold neutron beam intensity, while the existence of other beam hole and moderator does not give an important intensity reduction. (author).

7348 (KEK–90-25(v.1), pp. 408-415) **Some neutronic studies on flux-trap type moderator.** Kiyanagi, Y. (Hokkaido Univ., Sapporo (Japan). Faculty of Engineering); Watanabe, N. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

The neutronic performance of a flux-trap type moderator was studied by computer simulation in connection with the KENS-II target-moderator system. It was confirmed that this system can provide 1.3-1.4 times higher neutron intensity than a traditional wing-geometry moderator system. (author).

7349 (KEK–90-25(v.1), pp. 416-429) **Theoretical thermal-hydraulic investigations of the operational and safety features of the cold D_2-moderator for SINQ.** Skala, K. (Paul Scherrer Inst. (PSI), Villigen (Switzerland)); Spitzer, H.; Bauer, G.S. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

In order to be able to investigate the behaviour of the gas-liquid mixture in the rather complex vessel and pipe system of the cold D_2-moderator with heat exchanger and ballast volume, a computational model of the system has been set up. The model was first benchmarked against experimental data from the cold moderator mockup for the second cold source at the ILL Grenoble. It was then used to predict operational parameters such as pressure, velocity, moisture content and others of the system under normal conditions with the anticipated distribution of heat influx. Finally, the case of total loss of insulating vacuum was investigated. (author).

7350 (KEK–90-25(v.1), pp. 430-443) **Technical concept of the liquid D_2-cold moderator for SINQ.** Spitzer, H. (Paul Scherrer Inst. (PSI), Villigen (Switzerland)); Hoechli, A.; Bauer, G.S.; Wagner, W. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

At the continuous, high power Spallation Source SINQ design provisions have been made in the D_2O-moderator tank for both, a D_2- and H_2-cold moderator. While the H_2-moderator will be available as a long term option, the D_2-moderator, equipped with a neutron guide system will be a day-one facility to provide the low-energy neutrons for the guide-hall instrumentation. The paper describes details of the technical concept of the D_2-cold moderator which takes into account boundary conditions, considerations on flux optimization, operational feasibility and safety. (author).

7351 (KEK–90-25(v.1), pp. 444-453) **Thermodynamic considerations on self-regulating characteristics of a cold neutron source with a closed thermosiphon.** Kawai, Takeshi (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.); Utsuro, Masahiko; Ogino, Fumimaru. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

The present report describes that a cold neutron source (CNS) having a closed-thermosiphon cooling loop shows a self-regulating characteristic under thermal disturbances if the effect of the moderator transfer tube is negligible. Due to this property, the liquid level in the moderator cell is kept almost constant under thermal disturbances. The thermodynamic meaning of the self-regulating property in the idealized closed-thermosiphon and the effect of the moderator transfer tube to the self-regulation are described. (author).

7352 (KEK–90-25(v.1), pp. 463-470) **Simultaneous pulsed/integral neutron facility optimization.** Thorson, I.M. (TRIUMF, Vancouver, BC (Canada)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

The possibilities and compromises necessary in the design of a neutron facility that would serve both pulsed and time integral users simultaneously are examined. (author).

7353 (KEK–90-25(v.1), pp. 471-477) **A design concept of target-moderator-reflector assemblies for KENS-II: A high-efficiency pulsed spallation neutron source.** Watanabe, N. (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

A design concept of KENS-II target-moderator-reflector assemblies is described. One of the assemblies is dedicated to the cold neutron source, and the other, to the thermal and epithermal neutron source. A flux-trap type moderator-configuration was adopted with a vertical proton-beam injection scheme. All moderators for the cold neutron source are coupled liquid hydrogen moderators with premoderators. A new scheme of proton beam delivery is proposed. The new system can provide several times higher total performance than a reference system based on a traditional single assembly with all decoupled moderators in a wing geometry and with a horizontal proton-beam injection scheme. (author).

7354 (KEK–91-4) **Evaluation of wake fields of disk loaded structure for Japan Linear Collider.** Takao, M.; Higo, T.; Takata, K. National Lab. for High Energy Physics, Tsukuba, Ibaraki

(Japan). Jul 1991. 25p. Order Number DE92751023. Source: OSTI; NTIS (US Sales Only); INIS.

The numerical estimation of the long range wake fields of the accelerating structure for JLC was carried out by using various computer codes; TBCI, KN7C, TRANSVRS, and URMEL. It provides the basis of the argument on the energy distribution or the emittance growth of a multi-bunched beam. A large portion of the transverse wake field was found to be occupied by a dominant mode, lowest in frequency, while the contribution of the other modes were found at most twenty percent. On the wake field of the dominant mode, the estimation of the amount calculated by the above codes agreed within ten percent. The dependence of the wake fields on a geometric variation, i.e. an aperture, was also investigated. (author).

7355 (KEK–91-6) **Progress during the decade of the BSF beam-line.** Irie, Yoshiro; Adachi, Toshikazu; Yano, Yoshiharu; Fujimori, Hiroshi; Kaneko, Naokatsu; Kobayashi, Yasuo; Tahara, Toshihiro. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jul 1991. 39p. Order Number DE92751025. Source: OSTI; NTIS (US Sales Only); INIS.

Since the Booster Synchrotron Utilization Facility (BSF) came into operation in June, 1980, ten years have passed. This report summarizes the development of beam-line hardware and software system during the decade. Especially, the result on radiation protection along the beam-line is satisfactory. (author).

7356 (KURRI-TR–345, pp. 48-56) **Development of high performance neutron source using spallation: Neutron experiment facilities in the Japanese Hadron Project.** Watanabe, Noboru (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Mar 1991. (In Japanese). (CONF-9008225–: Specialists' meeting on physics and engineering of fission and spallation; Specialists' meeting on physics and engineering of fission and spallation, Kumatori (Japan); Kumatori (Japan), 2 Aug 1990; 10 jan 1991; CONF-9101117–). In *Proceedings of the specialists' meeting on physics and engineering of fission and spallation, 1990.* 118p. Order Number DE92713857. Source: OSTI; NTIS (US Sales Only); INIS.

One of the most important applications of nuclear fission and nuclear spallation is high performance neutron sources. The neutron sources mentioned here are those used for beam experiment in the research on material science and the basic physics of atomic nuclei and others. In the spallation neutron sources using medium energy proton accelerators, in the case of using nonactinide targets, nuclear fission takes part in addition to nuclear spallation, and in actinide system, nuclear fission and nuclear spallation coexist. The most important thing as high performance spallation neutron sources is that cold, thermal and epithermal neutron fluxes as high as possible can be obtained. As the spallation neutron source in Japan, KENS-1 was completed in 1980 for the first time in the world. KENS-2 is planned as a part of the Japanese Hadron Project. The optimization of a proton accelerator, the targets for generating neutrons, the coupling of a target with moderator, cold neutron sources and the distribution of proton pulses to a target, moderator and reflector assembly, and the new method of proton beam incidence are reported. (K.I.).

7357 (LA-UR–91-3908) **Existing muon beams at LAMPF.** Pillai, C. Los Alamos National Lab., NM (United States). [1991]. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-9105295–1: Philsosphenweg 12, Heidelberg (Germany), 7-9 May 1991). Order Number DE92005073. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the production of muon beams at LAMPF. The backward decay beam, forward decay beam, surface beam, cloud muon beam, and pion beams are all briefly discussed. (LSP)

7358 (LA-UR–91-4150) **Theory and modeling of a relativistic klystron amplifier with high space charge for microsecond applications.** Carlsten, B.E.; Fazio, M.V.; Faehl, R.J.; Kwan, T.J.; Rickel, D.G.; Stringfield, R.M. Los Alamos National Lab., NM (United States). [1992]. 28p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-920124–1: Society of Photo-Optical Instrumentation Engineers' international symposium on laser spectroscopy as part of SPIE's symposium on optics, electro-optics and laser applications in science and engineering, Los Angeles, CA (United States), 19 Order Number DE92004576. Source: OSTI; NTIS; INIS; GPO Dep.

We discuss basic Relativistic Klystron Amplifier physics. We show that in the intense space-charge regime the maximum power extraction does not coincide with the maximum harmonic bunching. In addition, we show that as the beam is bunched, the additional power stored in the Coulomb fields does not add significantly to the overall power extraction. Because of these effects, the power extraction at 1.3 GHz for a 500 kV, 5 kA beam with reasonable beam-to-wall spacing is limited to around 35%. 3 refs., 17 figs.

7359 (LBL–29973-Rev.) **Magnetic measurements at Lawrence Berkeley Laboratory: Revision.** Green, M.I.; Barale, P.; Callapp, L.; Case-Fortier, M.; Lerner, D.; Nelson, D.; Schermer, R.; Skipper, G.; Van Dyke, D.; Cork, C.; Halbach, K.; Hassenzahl, W.; Hoyer, E.; Marks, S.; Harten, T.; Luchini, K.; Milburn, J.; Tanabe, J.; Zucca, F.; Keller, R.; SLawrence Livermore National Lab., CA (United States). Aug 1991. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-910662–13-Rev.: 12. international conference on magnet technology, Leningrad (USSR), 23-28 Jun 1991). Order Number DE92004305. Source: OSTI; NTIS; INIS; GPO Dep.

Recent magnetic measurement activities at LBL have been concentrated in two separate areas, electro-magnets and permanent magnets for the Advanced Light Source (ALS), and superconducting magnets for the Superconducting Super Collider Laboratory (SSCL). A survey of the many different measurement systems is presented. These include: AC magnetic measurements of an ALS booster dipole engineering model magnet, dipole moment measurements of permanent magnet blocks for ALS wigglers and undulators, permeability measurements of samples destined for wiggler and undulator poles, harmonic error analysis of SSC one meter model dipoles and quadrupoles and five meter long SSC prototype quadrupoles, harmonic error analysis of ALS dipoles, quadrupoles, and sextupoles, precision Hall probe mapping of ALS storage ring combined function magnets, and the design of the ALS insertion device magnets mapping system. We also describe a new UNIX based data acquisition system that is being developed for the SSC. Probes used for magnetic measurements include Helmholtz coils, integral coils, point coils, and bucking harmonic analysis coils, several different types of Hall probes, and nuclear magnetic resonance magnetometers. Both analog and digital integrators are used with the coils. Some problems that occurred and their rectification is described. The mechanisms used include rotating systems with optical encoders, X-Y mapping systems with optical encoders and a laser position measuring device. 10 refs., 3 figs., 1 tab.

7360 (LBL–30672) **Performance of hole coupling resonator in the presence of asymmetric modes and FEL gain.** Xie, Ming; Kim, Kwang-Je. Lawrence Berkeley Lab., CA (United States). Aug 1991. 25p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-9108118–33: 13. international free-electron laser (FEL) conference, Santa Fe, NM (United States), 25-30 Aug 1991). Order Number DE92003907. Source: OSTI; NTIS; INIS; GPO Dep.

We continue the study of the hole coupling resonator for free electron laser (FEL) application. The previous resonator code is further developed to include the effects of the azimutally asymmetric modes and the FEL gain. The implication of the additional higher order modes is that there are more degeneracies to be avoided in tuning the FEL wavelengths. The FEL interaction is modeled by constructing a transfer map in the small signal regime and incorporating it into the resonator code. The FEL gain is found to be very effective in selecting a dominant mode from the azimuthally symmetric class of modes. Schemes for broad wavelength tuning based on passive mode control via adjustable apertures are discussed. 12 refs., 7 figs., 1 tab.

7361 (ORNL/TM–11854) **A short report on voltage-to-frequency conversion for HISTRAP RF system tuning control loops.** Hasanul Basher, A.M. Oak Ridge National Lab., TN (United States). Sep 1991. 26p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE92004106. Source: OSTI; NTIS; INIS; GPO Dep.

One of the requirements of the HISTRAP RF accelerating system is that the frequency of the accelerating voltage for the cavity must keep in step with the change in the magnetic field. As the energy of the particle increases, the magnetic field is increased to keep the radius of the particle orbit constant. At the same time, the frequency of the electric field must be changed to insure that it is synchronized with the angular movement of the particle. So we need to generate the frequency of the accelerating voltage in relation to the magnetic field. The frequency generation can be accomplished in two stages. The first stage of frequency generation consists of measuring the magnetic field in terms of voltage which is already developed. The second stage is to convert this voltage into frequency. Final frequency precision can be achieved by deriving a frequency-correcting signal from the beam position. This project is concerned with generating the frequency from the analog voltage. The speed of response required will place very stringent requirements on both hardware and software. Technology is available to carry out this task. A hardware configuration has been established and software has been developed. In the following section, we describe the implementation strategy, the hardware configuration, and the desired specifications. Next, we present the software developed, results obtained, along with capabilities and limitations of the system. Finally, we suggest alternate solutions to overcome some of the limitations toward meeting our goal. In the appendices, we include program listings.

7362 (ORNL/TM–11928) **Development of a remote control console for the HHIRF 25-MV tandem accelerator.** Hasanul Basher, A.M. Oak Ridge National Lab., TN (United States). Sep 1991. 40p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE92004107. Source: OSTI; NTIS; INIS; GPO Dep.

The CAMAC-based control system for the 25-MV Tandem Accelerator at HHIRF uses two Perkin-Elmer, 32-bit minicomputers: a message-switching computer and a supervisory computer. Two operator consoles are located on one of the six serial highways. Operator control is provided by means of a console CRT, trackball, assignable shaft encoders and meters. The message-switching computer transmits and receives control information on the serial highways. At present, the CRT pages with updated parameters can be displayed and parameters can be controlled only from the two existing consoles, one in the Tandem control room and the other in the ORIC control room. It has become necessary to expand the control capability to several other locations in the building. With the expansion of control and monitoring capability of accelerator parameters to other locations, the operators will be able to control and observe the result of the control action at the same time. Since the new control console will be PC-based, the existing page format will be changed. The PC will be communicating with the Perkin-Elmer through RS-232 and a communication software package. Hardware configuration has been established, a communication software program that reads the pages from the shared memory has been developed. In this paper, we present the implementation strategy, works completed, existing and new page format, future action plans, explanation of pages and use of related global variables, a sample session, and flowcharts.

7363 **A Stripline Fast Faraday Cup for measuring GHz structure of ion beams.** Bogaty, J.M. To Dept. of Energy. 1990. Filed date 3 Jul 1990. USA Patent patent application 7-547,748. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. Order Number DE92003819. Source: OSTI; NTIS; GPO Dep.

The Stripline Fast Faraday Cup is a device which is used to quantitatively and qualitatively measure gigahertz time structure characteristics of ion beams with energies up to at least 30 Mev per nucleon. A stripline geometry is employed in conjunction with an electrostatic screen and a Faraday cup to provide for analysis of the structural characteristics of an ion beam. The stripline geometry allows for a large reduction in the size of the instrument while the electrostatic screen permits measurements of the properties associated with low speed ion beams.

7364 (SLAC-PUB–5640) **Stanford Linear Collider magnet positioning.** Wand, B.T. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Aug 1991. 75p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-920332–1: 1992 American Society for Photogrammetry and Remote Sensing/American Congress on Surveying and Mapping (ASPRS/ACSM) annual convention, Albuquerque, NM (United States), 3-5 Mar 1992). Order Number DE91018883. Source: OSTI; NTIS; INIS; GPO Dep.

For the installation of the Stanford Linear Collider (SLC) the positioning and alignment of the beam line components was performed in several individual steps. In the following the general procedures for each step are outlined. The calculation of ideal coordinates for the magnets in the entire SLC will be discussed in detail. Special emphasis was given to the mathematical algorithms and geometry used in the programs to calculate these ideal positions. 35 refs., 21 figs.

7365 (SLAC-PUB–5698) **High current transistor pulse generator.** Nesterov, V.; Cassel, R. Stanford Linear Accelerator Center, Menlo Park, CA (United States). May 1991. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-911106–31: IEEE nuclear science symposium, Santa Fe, NM (United States), 5-9 Nov 1991). Order Number DE92004774. Source: OSTI; NTIS; INIS; GPO Dep.

A solid state pulse generator capable of delivering high current trapezoidally shaped pulses into an inductive load has been developed at SLAC. Energy stored in the capacitor bank of the pulse generator is switched to the load through a pair of Darlington transistors. A combination of diodes and Darlington transistors is used to obtain trapezoidal or triangular shaped current pulses into an inductive load and to recover the remaining energy in the same capacitor bank without reversing capacitor voltage. The transistors work in the switch mode, and the power losses are low. The rack mounted pulse generators presently used at SLAC contain a 660 microfarad storage capacitor bank and can deliver 400 amps at 800 volts into inductive loads up to 3 mH. The pulse generators are used in several different power systems, including pulse to pulse bipolar power supplies and in application with current pulses distributed into different inductive loads. The current amplitude and discharge time are controlled by the central computer system through a specially developed multichannel controller. Several years of operation with the pulse generators have proven their consistent performance and reliability. 8 figs.

7366 (SSCL–340) **Phase-control scheme for synchronous beam transfer from the low energy booster to the medium energy booster.** Mestha, L.K. Superconducting Super Collider Lab., Dallas, TX (United States). Sep 1991. 41p. Sponsored by U.S. DOE Energy Research. DOE Contract AC35-89ER40486. Order Number DE92004112. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the design philosophy of the new synchronization scheme for beam transfer from the Low Energy Booster (LEB) to the Medium Energy Booster at the Superconducting Super Collider. The fundamental principle of controlling the LEB acceleration is discussed. A generalized mathematical model is derived to facilitate the design of multiple feedback loops to control the synchronizing phase and the radial position of the beam. Applications of state feedback, sliding-mode and model reference controllers are discussed. Although the state feedback controller is easy to design and implement, the simulation results show that the controller properties are not useful to handle disturbance due to field errors and variation in the system parameters. The sliding-mode and model reference controllers are shown to have more suitable properties. At the end, mention of the hardware used to establish the "proof-of-principle" is given. 17 refs., 35 figs.

7367 (SSCL–479) **Supercomputing activities at the SSC Laboratory.** Yan, Y.; Bourianoff, G. Superconducting Super Collider Lab., Dallas, TX (United States). Sep 1991. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract AC35-89ER40486. Order Number DE92005177. Source: OSTI; NTIS; INIS; GPO Dep.

Supercomputers are used to simulate and track particle motion around the collider rings and the associated energy boosters of the Superconducting Super Collider (SSC). These numerical studies will aid in determining the best design for the SSC.

7368 (SSCL–559) **Beam control feedback loops for the low energy booster.** Mestha, L.K. Superconducting Super Collider

Lab., Dallas, TX (United States). Oct 1991. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC35-89ER40486. Order Number DE92004955. Source: OSTI; NTIS; INIS; GPO Dep.

There are several feedback loops associated with a basic low-level rf system for the Low Energy Booster (LEB) of the Superconducting Super Collider. The goal of the system is to be able to bunch the beam, accelerate it, and extract it to the Medium Energy Booster (MEB). A precise control of the frequency, phase, and amplitude of the cavity gap voltage is required. Although, the number of parameters to be ultimately controlled does not appear to be high, in practice controlling them is complicated. Hence we have made an effort here to outline all the necessary feedback loops, including those being used for the cavity. Requirements and design goals for some of them are highlighted.

7369 (SSCL-Preprint–6) **About the mechanics of SSC dipole magnet prototypes.** Devred, A. (Superconducting Super Collider Lab., Dallas, TX (United States)); Bush, T.; Coombes, R.; DiMarco, J.; Goodzeit, C.; Kuzminski, J.; Puglisi, M.; Radusewicz, P.; Sanger, P.; Schermer, R.; Spigo, G.; Tompkins, J.; Turner, J.; Wolf, Z.; Yu, Y.; ZheSuperconducting Super Collider Lab., Dallas, TX (United States). Nov 1991. 63p. Sponsored by U.S. DOE Energy Research. DOE Contract AC35-89ER40486. (LBL–31571;FNAL/Pub–91/330;CONF-8908289–1: The physics of particle accelerator school, Brookhaven, IL (United States), Aug 1989). Order Number DE92004526. Source: OSTI; NTIS; INIS; GPO Dep.

During the last two years, nine 4-cm-aperature, 17-m-long dipole magnet prototypes were produced by Brookhaven National Laboratory (BNL) under contract with the Superconducting Super Collider (SSC) Laboratory. These prototypes are the last phase of a half-decade-long R&D program, carried out in collaboration the Fermi National Accelerator Laboratory and Lawrence Berkeley Laboratory, and aimed at demonstrating the feasibility of the SSC main-ring dipole magnets. They also lay the groundwork for the 5-cm-aperture dipole magnet program now underway. After reviewing the design features of the BNL 4-cm-aperature, 17-m-long dipole magnets, we describe in detail the various steps of their fabrication. For each step, we discuss the parameters that need to be mastered, and we compare the values that were achieved for the nine most recent prototypes. The data appear coherent and reproducible, demonstrating that the assembly process is under control. We then analyze the mechanical behavior of these magnets during cooldown and excitation, and we attempt to relate this behavior to the magnet features. The data reveal that the mechanical behavior is sensitive to the collar-yoke interference and that the magnets exhibit somewhat erratic changes in coil end-loading during cooldown.

7370 (UCRL–53868-90, pp. 1.19-1.23) **AMOS accelerator modeling code development.** Shang, C.C.; DeFord, J.F. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90*. 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

The authors describe a new numerical procedure by which field calculations in AMOS are upgraded to more accurately model rotationally symmetric cavity structures such as accelerator cells. Their development work is aimed at implementing a modified finite difference update scheme on an irregular grid system. Elements of an irregular grid may be chosen to fit object boundaries more closely, giving an increased solution accuracy. Their approach involves the placement of field components on a conforming electric field grid and on a magnetic field dual grid which is orthogonal to the primary grid. They find that this procedure retains several important computational advantages, including the ability to exploit the implied spatial relationships between nodes. Propagating fields on an irregular grid system have been observed, and comparisons between finite difference AMOS and Modified-Yee AMOS field calculations are provided.

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Refer also to citation(s) 7356, 7443

7371 (BNL–46799) **40-Å FEL designs for the PEP storage ring.** Fisher, A.S. (Brookhaven National Lab., Upton, NY (United States)); Gallardo, J.C.; Nuhn, H.D.; Tatchyn, R.; Winick, H.; Pellegrini, C. Brookhaven National Lab., Upton, NY (United States). [1991]. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016 ;AC03-76SF00515. (CONF-9108118–37: 13. international free-electron laser (FEL) conference, Santa Fe, NM (United States), 25-30 Aug 1991). Order Number DE92005037. Source: OSTI; NTIS; INIS; GPO Dep.

We explore the use of the 2.2-km PEP storage ring at SLAC to drive a 40-Å free-electron laser in the self-amplified spontaneous emission configuration. Various combinations for electron-beam and undulator parameters, as well as special undulator designs, are discussed. Saturation and high peak, in-band, coherent power (460 MW) are possible with a 67-m, hybrid permanent-magnet undulator in a ring bypass. A 100-m, cusp-field undulator can achieve high average, in-band, coherent power (0.25 W) in the main ring. The existing, 25.6-m, Paladin undulator at LLNL, with the addition of optical-klystron dispersive sections, is considered for both peak and average power. 35 refs., 4 figs., 1 tab.

7372 (BNL–46810) **Performance and upgrades of the NSLS storage rings and photon sources.** Brookhaven National Lab., Upton, NY (United States). [1991]. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-910730–27: 4. international conference on synchrotron radiation instrumentation, Chester (United Kingdom), 15-19 Jul 1991). Order Number DE92004993. Source: OSTI; NTIS; INIS; GPO Dep.

The usefulness of synchrotron radiation sources is not only determined by current, energy and magnetic field but also orbit stability and lifetime. The status and developments at NSLS in storage ring performance are discussed. Efforts at NSLS to look toward the future in source development are presented. In particular, small gap undulator development and studies toward development of UV Free Electron Laser at the Accelerator Test Facility are described. 5 refs., 2 figs., 1 tab.

7373 (JAERI-M–91-155) **The effect of magnetic field shape on undulator radiation spectrum.** Matsuki, Nobuo (JAERI-RIKEN SPring-8 Project Team, Tokyo (Japan)); Sasaki, Shigemi. Japan Atomic Energy Research Inst., Tokyo (Japan). Oct 1991. 23p. (In Japanese). Order Number DE92751045. Source: OSTI; NTIS (US Sales Only); INIS.

Comparisons of the undulator radiation spectra from various ideal shapes of the on-axis magnetic field strengths in undulator were made. The computations were performed for the 'sinusoidal' shape, the 'triangular' shape, the 'rectangular' shape and the 'power of sinusoidal' shape of magnetic fields. For all cases, 0.3 GeV electron energy, 80 mm magnetic period length and 12 magnetic periods were assumed. The remarkable changes of peak intensities for the third harmonic and the fifth harmonic of undulator radiations were observed. Whereas the fundamental peaks had no remarkable changes. The peak intensities of the 5th harmonics for the triangular and the rectangular shapes of magnetic fields were 1.5 and 0.6 times higher than that for the sinusoidal shape, respectively. Higher peak intensities for higher harmonics of undulator radiation were observed for higher power of sinusoidal shape of magnetic fields. (author).

7374 (KEK–90-21, pp. 49-63) **A review of self-consistent integral equations for the stationary distribution in electron bunches.** Zotter, B. (European Organization for Nuclear Research, Geneva (Switzerland)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Feb 1991. (CONF-9009292–: 4. advanced ICFA beam dynamics workshop on collective effects in short bunches, Tokyo (Japan), 22-29 Sep 1990). In *Fourth advanced ICFA beam dynamics workshop on collective effects in short bunches*. 202p. Order Number DE92713858. Source: OSTI; NTIS (US Sales Only); INIS.

Several versions of the self-consistent integral equation for bunch lengthening have been used by various authors. They all derive from the 'Haissinski equation' and differ mainly in the integration limits. Using only causality, it can be shown that all of them are equivalent. We discuss various techniques used to obtain solutions and the calculations of their stability. An explicit analytic solution is possible for the case of a purely resistive impedance, while an inductive impedance leads to an implicit algebraic equation. Approximate solutions are presently being developed also for resonator impedances. The threshold for 'turbulent' bunch lengthening has been obtained from perturbation solutions of the time-dependent Vlasov equation. The values agree with simulation, but appear to be rather large, in particular for very short bunches. (author).

7375 (KEK–90-21, pp. 64-72) **Effects of the potential-well distortion on the longitudinal single-bunch instability.** Oide, Katsunobu (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Feb 1991. (CONF-9009292–: 4. advanced ICFA beam dynamics workshop on collective effects in short bunches, Tokyo (Japan), 22-29 Sep 1990). In *Fourth advanced ICFA beam dynamics workshop on collective effects in short bunches.* 202p. Order Number DE92713858. Source: OSTI; NTIS (US Sales Only); INIS.

Effects of the potential-well distortion on the longitudinal single-bunch instability in an electron storage ring are examined. A method which calculates the intensity threshold including the potential well is proposed. As the result, the spectra of the eigenvalues and the threshold of the instability become greatly different from those calculated without the potential-well distortion. (author).

7376 (KEK–90-21, pp. 73-82) **A new type of bunch lengthening.** Hirata, Kohji (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)); Petracca, S.; Ruggiero, F. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Feb 1991. (CONF-9009292–: 4. advanced ICFA beam dynamics workshop on collective effects in short bunches, Tokyo (Japan), 22-29 Sep 1990). In *Fourth advanced ICFA beam dynamics workshop on collective effects in short bunches.* 202p. Order Number DE92713858. Source: OSTI; NTIS (US Sales Only); INIS.

Using a constant wake localized at one point in a ring as an example, it is shown how the feature of the bunch lengthening for the highly localized wake is different from that predicted by the conventional theory where the wake force is averaged over one turn. For this example, the space of parameters (strength of the wake force, synchrotron tune and the damping time) is classified into three regions: (1) only a period-one fixed point exists, (2) only a period-two fixed point exists and (3) both types of fixed points can exist (bistable regime). This feature is predicted by a Gaussian model and confirmed by multi-particle tracking. (author).

7377 (KEK–90-21, pp. 90-100) **The device for bunch selffocusing.** Burov, A.V. (AN SSSR, Novosibirsk (USSR). Inst. Yadernoj Fiziki); Novokhatski, A.V. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Feb 1991. (CONF-9009292–: 4. advanced ICFA beam dynamics workshop on collective effects in short bunches, Tokyo (Japan), 22-29 Sep 1990). In *Fourth advanced ICFA beam dynamics workshop on collective effects in short bunches.* 202p. Order Number DE92713858. Source: OSTI; NTIS (US Sales Only); INIS.

The new device for damping the longitudinal single bunch instability in storage rings is proposed. This simple device is the dielectric canal insert of definite length in vacuum chamber. The structure of wake fields, induced by intensive bunch in such a canal is that, that backward action on bunch particles not only preserves but also decreases bunch length, i.e. leads to bunch selffocusing. The conditions under which this phenomenon reveals itself and can be applied to storage rings are considered. (author).

7378 (KEK–90-21, pp. 36-48) **Weak turbulence and the heating of the beam near the threshold of instability.** Pestrikov, D. (AN SSSR, Novosibirsk (USSR). Inst. Yadernoj Fiziki). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Feb 1991. (CONF-9009292–: 4. advanced ICFA beam dynamics workshop on collective effects in short bunches, Tokyo (Japan), 22-29 Sep 1990). In *Fourth advanced ICFA beam dynamics workshop on collective effects in short bunches.* 202p. Order Number DE92713858. Source: OSTI; NTIS (US Sales Only); INIS.

In storage rings, the bunch length and momentum spread can increase with the intensity. In many cases, such effects are associated with the unstable longitudinal coherent oscillation of the bunch and the related turbulent phenomena. The theoretical and experimental studies of this subject show that depending on the specific conditions, the instability stops when the bunch momentum spread either reaches the value corresponding to the threshold of instability or overshoots it. In this paper, the simplest case when beam and its coherent oscillation evolve near the threshold of negative mass instability is discussed. Besides the mathematical simplification, the results of such calculation can be used as heuristic ones to predict the behavior of very short bunches, when it may be expected that instability rate significantly exceeds the frequency of synchrotron oscillation. From the equation for negative mass instability, the phase trajectory of a particle is determined. The basic properties of the solution and the influence of nonlinear terms are discussed. (K.I.).

7379 (KEK–90-21, pp. 83-89) **Longitudinal transient problems.** Wang, Jiunn-Ming (Brookhaven National Lab., Upton, NY (United States)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Feb 1991. (CONF-9009292–: 4. advanced ICFA beam dynamics workshop on collective effects in short bunches, Tokyo (Japan), 22-29 Sep 1990). In *Fourth advanced ICFA beam dynamics workshop on collective effects in short bunches.* 202p. Order Number DE92713858. Source: OSTI; NTIS (US Sales Only); INIS.

In this paper, a simplified method of treating the longitudinal transient problems in a linac or in a storage ring is proposed. The simplification comes about because the Vlasov equation is solved accurately only up to the first order in the frequency slip factor. To this order of approximation, Landau damping is ignored. The longitudinal position of a beam particle is characterized by a variable s. In a linac, s is the distance from the entrance of the linac to where the particle is, and in a storage ring, it is the longitudinal Serret-Frenet coordinate. This variable is treated as the independent variable of the equation of motion. The equation of motion and the Vlasov equation corresponding to the equation of motion are written. For the purpose of investigating the change of the energy spread in a linac or a storage ring, the energy moments are defined. The simplified equation is derived. The longitudinal electric field induced by beam current is given. The simplified equation can be solved easily as an initial value problem for the case of a coasting beam in a storage ring. The well known results describing the longitudinal instability of a small bunch inside a storage ring, Robinson mode, are derived. (K.I.).

7380 (KEK–90-21, pp. 101-108) **The cure of transverse mode coupling instability in Super-ACO.** Level, M.P. (Paris-11 Univ., 91 - Orsay (France). Lab. pour l'Utilisation du Rayonnement Electromagnetique (LURE)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Feb 1991. (CONF-9009292–: 4. advanced ICFA beam dynamics workshop on collective effects in short bunches, Tokyo (Japan), 22-29 Sep 1990). In *Fourth advanced ICFA beam dynamics workshop on collective effects in short bunches.* 202p. Order Number DE92713858. Source: OSTI; NTIS (US Sales Only); INIS.

The design of Super-ACO foresaw two main modes of operation : high flux (all bunches filled), and temporal structure (one or a few bunches filled). The intensity in the last mode would be limited to about 30 mA per bunch due to the transverse mode coupling instability. In this paper we show that an increase of chromaticity pushes the limit away, keeping the transverse modes well separated. The intensity per bunch can be increased above 165 mA only limited by injection rate and beam lifetime. Consequently, the mode operation for temporal structure 2 bunches with 240 mA suits also to users who need high flux, then time is presently equally shared between the two modes of operation. (author).

7381 (KEK–90-21, pp. 116-117) **Single bunch beam breakup.** Gluckstern, R.L. (Maryland Univ., College Park, MD (United States). Dept. of Physics); Neri, F.; Van Zeijts, J.B.J. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Feb 1991. (CONF-9009292–: 4. advanced ICFA beam dynamics workshop on collective effects in short bunches, Tokyo (Japan), 22-29 Sep 1990). In *Fourth advanced ICFA beam dynamics workshop on collective effects in short bunches.* 202p. Order Number DE92713858. Source: OSTI; NTIS (US Sales Only); INIS.

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MOMENTUM; FOCUSING; CHARGE DENSITY; CAVITY RESONATORS

7382 (KEK–90-21, pp. 118-125) **On the beam break-up instability in storage rings.** Pestrikov, D.V. (AN SSSR, Novosibirsk (USSR). Inst. Yadernoj Fiziki). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Feb 1991. (CONF-9009292–: 4. advanced ICFA beam dynamics workshop on collective effects in short bunches, Tokyo (Japan), 22-29 Sep 1990). In *Fourth advanced ICFA beam dynamics workshop on collective effects in short bunches.* 202p. Order Number DE92713858. Source: OSTI; NTIS (US Sales Only); INIS.

Numerous coherent instabilities of bunched beams in storage rings can be associated with the interaction of particles with the low Q-value elements of the vacuum chamber. Traditionally this scope of problems is solved by the calculation of the eigenfrequency spectra for the linearized system of Vlasov's equation. In this report, only the main features of fast transverse coherent single-turn instability and the main stabilizing factors for these oscillations are briefly discussed. For the sake of simplicity, it is assumed that only vertical coherent oscillations are excited in beam. The formula for the unperturbed oscillations of particles is described. The mathematical procedure is explained. The damping of considered instability is discussed. By the detuning of head-on and tail-on particles, the oscillations can be damped. The action of beam cooling and Landau damping on fast coherent oscillations is considered. The BNS damping is discussed. The simple calculation of the BNS damping can be done. It sufficiently uses the resonant nature of instability, and assumes suppression by the introduction of the deviation of particle oscillation frequency along a bunch. (K.I.).

7383 (KEK–91-5) **Report from 'Orbit sub-group' of task force for MR synchrotron radiation project.** Kobayashi, M. (ed.). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jul 1991. 133p. (In Japanese). Order Number DE92751024. Source: OSTI; NTIS (US Sales Only); INIS.

This report includes feasibility studies for a new synchrotron radiation source using TRISTAN Main Ring (MR) of KEK now being used as an electron and positron collider. A task force for the feasibility study started in the spring of 1990, and a sub-group was organized to study and discuss the problems related to the lattice of MR. The main subject in this report is how to realize both very small emittance and large dynamic aperture in a new lattice. Two long straight sections in the present lattice called 'Nikko' and 'Oho' must be modified like a gable roof, 1) to get free space for insertion devices, 2) to extract their synchrotron radiation to the experimental hutches which will be set in the ring tunnel in those sections and 3) to add a radiation shielding wall between the ring and the beam channel for the synchrotron radiation. The other two long straight sections called 'Fuji' and 'Tsukuba' will be used for injection, RF cavities and damping wigglers necessary for the very low emittance. The ultimate emittance will be 1.6 nm rad with the horizontal dynamic aperture of 36 x 10^{-6} m rad that is about half the aperture experienced at the present MR. (author).

7384 (KEK–91-7) **Reinforcement of the high-power RF source at the Photon Factory storage ring.** Sakanaka, S.; Izawa, M.; Kobayakawa, H.; Tokumoto, S.; Kiuchi, T. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Aug 1991. 65p. Order Number DE92751026. Source: OSTI; NTIS (US Sales Only); INIS.

Four single-cell cavities are used for beam acceleration in the Photon Factory storage ring. An RF power was supplied by two 180-kW klystrons until July, 1988. The maximum stored current of the ring was 370 mA, limited by the available RF-power. In order to store more high-current beams, the RF-power source was reinforced by an addition of two klystrons in 1988. Hence, each cavity is driven by a single klystron. Related devices such as a high-voltage power supply for the klystron, a circulator, waveguides and low-level RF circuits were newly installed. The reinforcement allowed us to achieve a stored current of 500 mA at 2.5 GeV. (author).

7385 (LBL–30457) **Diagnostic beam line for a third generation storage ring.** Perera, R.C.C.; Melczer, M.E.; Warwick, A.; Jackson, A.; Kincaid, B.M. Lawrence Berkeley Lab., CA (United States). 15 May 1991. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE92003969. Source: OSTI; NTIS; GPO Dep.

A knowledge of the position, size, and stability of the source and the angle of emission of synchrotron radiation (SR) from the storage ring are essential for optimizing the operation of storage ring, insertion device and monochromators. Berkeley's Advanced Light Source (ALS) has a natural emittance of 3.4 x 10^{-9} m-rad, and has beam sizes σ_h and σ_v (assuming a 10% emittance ratio into the vertical direction) in bending magnet 1 (BM1) of 44 μm and 83 μm respectively. Simple diffractive optical calculations show that imaging this beam using visible light optics is not feasible and imaging must be performed using photon energies greater than 50 eV. This will be the same for all third generation low emittance storage rings. The synchrotron radiation diagnostics at ALS will consist of an imaging system for 200 eV photons and a "white beam" port with a streak camera to obtain the timing information. The imaging system will employ two crossed spherical mirrors in a Kirkpatrick-Baez configuration, to eliminate astigmatism. Use of 1:1 imaging will eliminate coma, resulting in an image of the source which is only limited by the residual aberrations of the optics. Real time imaging of the beam is deemed feasible by the use of a high resolution CCD, and the associated electronics necessary to read the CCD. The design of the imaging system of the diagnostic beam line for ALS and the detection system will be discussed with a view toward applications in other third generation SR sources. 6 refs.

7386 (LBL–31434) **Beam-beam dynamics during the injection process at the PEP-II B-Factory.** Chin, Yong Ho. Lawrence Berkeley Lab., CA (United States). Oct 1991. 20p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE92004097. Source: OSTI; NTIS; INIS; GPO Dep.

This paper is concerned with beam-beam effects during the injection process at the proposed asymmetric SLAC/LBL/LLNL B-Factory based on PEP (PEP-2). For symmetric colliders, the primary source of the beam-beam effect is the head-on collision at the interaction point (IP), and this effect can be mitigated by separating the beams during the injection process. For an asymmetric collider, which intrinsically consists of two separate rings, the bunches not only collide at the IP but experience a long-range beam-beam force on the way into and out of the IP region. These collisions are called "parasitic crossings (PC)." The parasitic crossings emerge as a potential source of far stronger beam-beam impact during the injection process for the following reason. In the proposed injection scheme of the APIARY-6.3d design, the bunches are injected horizontally into the two rings with large horizontal offset of $8\sigma_{Ox}{}^{sptm}$ where $\sigma_{Ox}{}^{sptm}$ is the nominal horizontal storage ring beam size at the end of the septum magnet. Then, the injected beam starts to travel around the ring oscillating horizontally. For the sake of discussion, let us assume that the beam in the other ring has already been fully stored. When the injected beam arrives at the 1st PC, where the two nominal orbits are separated horizontally by about 7.6 times the nominal horizontal beam size of the low energy ring, it may pass through the other beam far more closely than at the nominal separation distance, or it may even strike the other beam head-on.

44 INSTRUMENTATION

7387 (ORNL–6635/V2) **Instrumentation and Controls Division progress report for the period July 1, 1988 to June 30, 1990: Volume 2.** Klobe, L.E. (ed.). Oak Ridge National Lab., TN (United States). Dec 1990. 56p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE92004584. Source: OSTI; NTIS; INIS; GPO Dep.

The format of this Instrumentation and Controls Division progress report is a major departure from previous reports. This report has been published in two volumes instead of one, and the description of individual activities have been shortened considerably to make it easier document to scan and to read. Volume 1 of this report presents brief descriptions of a few highly significant programmatic and technological efforts representative of Instrumentation and Controls Division activities over the past two years. This volume contains information concerning the publications, presentations, and other professional activities and achievements of I&C Division staff members.

4401 Radiation Instrumentation

Refer also to citation(s) 6488, 6495, 6717, 7004, 7056, 7212, 7235, 7294, 7302, 7311, 7330, 7578, 7836, 7863, 7866, 7917, 7944, 7995, 8008, 8031, 8109, 8216, 8217, 8218, 8219, 8220, 8221, 8432

7388 (ANL/CP–74511) **New radiation hodoscope developments for Arms Control Treaty verification.** Dickerman, C.E.; Doerner, R.C.; Regis, J.P.; Rhodes, E.A.; Stanford, G.S.; Travis, D.J.; DeVolpi, A. Argonne National Lab., IL (United States). [1991]. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-31109-ENG-38. (CONF-911106–15: IEEE nuclear science symposium, Santa Fe, NM (United States), 5-9 Nov 1991). Order Number DE92003391. Source: OSTI; NTIS; GPO Dep.

New developments in hodoscope radiation detection technology offer a wide range of unique capabilities for arms control treaty verification (ACTV) applications. Originally developed for civilian nuclear power research by Argonne National Laboratory, this concept uses an array of radiation detectors to image or detect objects inside opaque containments. Hodoscope systems may detect neutrons and/or gamma-rays. The systems may be based on transmission of radiation through the objects; may detect radiation stimulated in the objects, or may detect intrinsic object radiation. ACTV hodoscopes do not require the high-speed data acquisition systems or the heavy shielding and collimation of reactor hodoscopes, and relatively weak radiation sources are sufficient. We have performed laboratory measurements to demonstrate a range of potential applications. Gamma-ray transmission hodoscopes can be used to inspect canisters, rail cars, etc. to monitor objects such as rocket motors. The use of relatively weak radiation sources makes it unnecessary to employ expensive and high-intensity accelerators. The heavy metal of nuclear warheads is characterized by strong gamma-ray absorption, and these materials could be counted by low-resolution tomography. Absorbers located in line with objects will themselves be detected, and sources located in the object region will be subtracted out as background. Intrinsic gamma-ray radiation from warheads also can be detected in a passive-instrument mode. Neutron hodoscopes can utilize neutron transmission, intrinsic neutron emission, or neutron-producing reactions (either prompt or delayed) stimulated by a neutron source. Monitoring of rocket motors enclosed in canisters/rail cars is the focus of the most recent ACTV hodoscope research and development activities. 3 refs., 5 figs., 2 tabs.

7389 (ANL/CP–74572) **Associated-particle sealed-tube neutron generators and hodoscopes for NDA applications.** Rhodes, E. (Argonne National Lab., IL (United States)); Peters, C.W. Argonne National Lab., IL (United States). [1991]. 23p. Sponsored by U.S. DOE Defense Programs; U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract W-31109-ENG-38. (CONF-9111125–1: 20. Japan conference on radiation and radioisotopes, Tokyo (Japan), 12-14 Nov 1991). Order Number DE92003423. Source: OSTI; NTIS; INIS; GPO Dep.

With radioisotope sources, gamma-ray transmission hodoscopes can inspect canisters and railcars to monitor rocket motors, can detect nuclear warheads by their characteristic strong gamma-ray absorption, or can count nuclear warheads inside a missile by low-resolution tomography. Intrinsic gamma-ray radiation from warheads can also be detected in a passive mode. Neutron hodoscopes can use neutron transmission, intrinsic neutron emission, or reactions stimulated by a neutron source, in treaty verification roles. Gamma-ray and neutron hodoscopes can be combined with a recently developed neutron diagnostic probe system, based on a unique associated-particle sealed-tube neutron generator (APSTNG) that interrogates the object of interest with a low-intensity beam of 14-MeV neutrons, and that uses flight-time to electronically collimate transmitted neutrons and to tomographically image nuclides identified by reaction gamma-rays. Gamma-ray spectra of resulting neutron reactions identify nuclides associated with all major chemicals in chemical warfare agents, explosives, and drugs, as well as many pollutants and fissile and fertile special nuclear material. 5 refs., 12 figs.

7390 (ANL/CP–74584) **Self-recovering superconducting strip detectors.** Gabutti, A.; Gray, K.E. Argonne National Lab., IL (United States). Sep 1991. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-9109317–1: 4. international workshop on low temperature detectors and dark matter, Oxford (United Kingdom), 4-7 Sep 1991). Order Number DE92004148. Source: OSTI; NTIS; INIS; GPO Dep.

Using a 1.8 μm wide superconducting strip made of granular tungsten, we have observed self-recovering pulses when the detector is irradiated with a ^{55}Fe 6 keV X-rays source. For low values of the bias current (i.e. $I_b<30\mu A$ at $T_b=1.5K$) the superconducting state is recovered in 10–50 ns giving voltage pulses across the strip of few hundred μv in amplitude. At high bias currents the detector did not self-recover and a constant counting efficiency has measured at different operating temperatures. There are good indications that this high counting rate can be extended to all the reduced bias currents where the detector is able to reset itself after every switch. The current threshold between collapsing and propagating switches and the time evolution of the voltage pulses can be described using a thermal propagation model developed in previous works. The ability of detectors to automatically recover the superconducting state in a short period of time after sensing a particle is encouraging in the feasibility study of fast superconducting microvertex detectors and also confirm the potential application of superconducting strips as high fast resolution X-rays detectors.

7391 (ANL-HEP-TR–91/100) **Some physics requirements for triggering in the intermediate tracking system of SDC.** Trost, H.J. Argonne National Lab., IL (United States). High Energy Physics Div. 22 Nov 1991. 30p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. Order Number DE92005226. Source: OSTI; NTIS; INIS; GPO Dep.

I have investigated trigger requirements for the intermediate tracking system of the SDC detector, using muons in the final states of some physics processes of interest and relevance to the program envisaged to be pursued at the SSC. The study is done at the physics event generator level with the PYTHIA package, augmented by a very simplistic simulation of the momentum measurement expected from the intermediate tracking system. For the range in pseudorapidity of $|\eta|$ = 1.7–2.5, I find a subdivision into four basic bins sufficient to ensure that the width of the transverse momentum trigger threshold will not be dominated by the lack of knowledge of the polar angle. In addition, the azimuthal resolution has be better than 1 mrad to allow transverse momentum thresholds from $p_t\approx10$ GeV/c up to and beyond $p_t=20$ GeV/c to be implemented which are needed to accomplish the physics goals. 10 figs., 1 tab.

7392 (BONN-IR–90-31) **Driving of the laser beam in the calibration system of the jet chamber of the OPAL detector.** Neumann, H. Bonn Univ. (Germany). Physikalisches Inst.; Bonn Univ. (Germany). Mathematisch-Naturwissenschaftliche Fakultaet. Jun 1990. 54p. (In German). Order Number DE92759284. Source: OSTI; NTIS (US Sales Only); INIS.

The OPAL jet chamer is calibrated by means of UV-Laser beams. A complex optical system containing 226 mirrors has been set up to guide the beams into the chamber. The distance between Laser and chamber is about 16 m and the beams have to be positioned in the chamber with an accuracy better than 0.5 mm. The beam position is measured by 96 Lateral Effect Diodes with a spatial resolution of about 80 μm and controlled by microcomputer systems (VME) which steer 4 movable mirrors with a precision of 5 μm. A control program has been tested first with a simulation of the Laser calibration system. It operates successfully since LEP start. Stability has been investigated - especially the independence of the control program on critical mechanical parameters. (orig.).

7393 (BONN-IR–91-12) **Search for possible geometrical deformations of the anode planes of the OPAL jet chamber.** Bug, S. Bonn Univ. (Germany). Physikalisches Inst.; Bonn Univ. (Germany). Mathematisch-Naturwissenschaftliche Fakultaet. Feb 1991. 72p. (In German). Order Number DE92758860. Source: OSTI; NTIS (US Sales Only); INIS.

The possibility of geometrical deformations of the anode planes of the OPAL jet chamber has been investigated. Using an UV laser beam, which passes through the chamber under various well-known angles Θ wrt the symmetry axis, possible deformations can be determined from studies of the track sagittae as function of the angle Θ. A small torsion of the detector end cones has been found, resulting in a displacement at outer radii of about 100 μm. The deformations of the suspensions of the anode wires are smaller than about 20-30 μm. The extra error of the transverse momentum due to geometrical deformations is $\sigma P_t/P_t \simeq 3\%$ for momenta of 45 GeV/c and a magnetic field of 4.35 kG. (orig.).

7394 (BONN-IR–91-23) **The uranium calorimeter of the ZEUS detector - studies on the uniformity of the energy measurement of electrons.** Prange, K. Bonn Univ. (Germany). Physikalisches Inst.; Bonn Univ. (Germany). Mathematisch-Naturwissenschaftliche Fakultaet. Apr 1991. 45p. (In German). Order Number DE92758861. Source: OSTI; NTIS (US Sales Only); INIS.

To meet the physics goals at the ep-collider HERA, the compensating uranium scintillator sandwich calorimeter for the ZEUS-Detector has an energy resolution $\sigma/E = 35\%/\sqrt{E} + \sigma_{cal}$; the total calibration error σ_{cal} including overall spatial nonuniformity should be less than 2%. Inhomogeneities occur at the edges of scintillator readout segments. They influence the spatial uniformity of the response of EMC-sections within a calorimeter module as well as between adjacent modules. Both items have been investigated in beam measurements with a spatial granularity of about 1 mm. The nonuniformity for electrons due to the EMC-segmentation within a calolrimeter module is less than 8.3%. That effect is observed in a region of ±4 mm [FWHM] for perpendicular electron incidence. The inhomogeneity at the transition of two modules is compensated by a lead foil of 2.6 mm. Investigations with the prototype calorimeter show the effect on average energy measurement for the ZEUS geometry to be below 2%. (orig.).

7395 (BONN-IR–91-24) **Construction of a test facility for the readout electronics of the ZEUS calorimeter.** Geitz, G. Bonn Univ. (Germany). Physikalisches Inst.; Bonn Univ. (Germany). Mathematisch-Naturwissenschaftliche Fakultaet. May 1991. 77p. (In German). Order Number DE92758862. Source: OSTI; NTIS (US Sales Only); INIS.

The Uranium-Scintillator Calorimeter for the ZEUS Detector at HERA is read out by pulse-shaping front-end electronics which take samples on the stretched photomultiplier pulses and store them as analog voltages. After each trigger decision, the data is then digitized. By equalizing the calorimeter response to hadrons and electrons of the same energy and by minimisation of systematic errors a hadronic resolution of $\sigma_E/E = 35\%/\sqrt{(E/GEV)} + 2\%$ is achieved. To ensure a calibration of the calorimeter to better than 2%, an electronics calibartion has to be done for each readout channel which corrects for inequalities and sets the energy scale. A test facility designed to carry out series measurements and special investigations on the analog electronics has been built. A description of this facility and of the first measurements made with it are given. (orig.).

7396 (BONN-IR–91-25) **Calibration of the electromagnetic part of the ZEUS calorimeter with electrons.** Bargende, A. Bonn Univ. (Germany). Physikalisches Inst.; Bonn Univ. (Germany). Mathematisch-Naturwissenschaftliche Fakultaet. May 1991. 42p. (In German). Order Number DE92759275. Source: OSTI; NTIS (US Sales Only); INIS.

Ten modules of the Uranium-Scintillator-Calorimeter for ZEUS were exposed to the X5-beam at CERN. The momentum of the beam is determined with an accuracy of better than 1.1%. From measurements with electrons in the energy range of 10 to 110 GeV we obtain the following results. The energy resolution is found to be better than $18\% /\sqrt{E/GeV}$. A worse resolution measured in the HACO-towers is explained by averaging effects over the beam size. The uranium noise provides an intercalibration of the calorimeter sections within 1.1% for electron signals in the FCAL (1.5% in RCAL). The linearity of the FCAL is better than 0.5%. Nonlinearities of 2% in the RCAL are mainly caused by the photomultipliers. (orig.).

7397 (BONN-IR–91-37) **Changing of the ELAN data acquisition to an integrated system with VME frontend acquisition and VAX work station analysis.** Foerster, W. Bonn Univ. (Germany). Physikalisches Inst.; Bonn Univ. (Germany). Mathematisch-Naturwissenschaftliche Fakultaet. Jul 1991. 61p. (In German). Order Number DE92758858. Source: OSTI; NTIS (US Sales Only); INIS.

A new data acquisition system for the experiment ELAN at the electron stretcher accelerator ELSA had become necessary due to changes in the experimental setup. The data acquisition and analysis which formerly both were performed by a single computer system are now separately done by a VMEbus-Computer and a VAX-Workstation. Based on the software components MECDAS (Mainz Experiment Control and Data Acquisition System) and GOOSY (GSI Online Offline System) a powerfull tool for data acquisition and analysis has been adapted to the requirements of the ELAN experiment. (orig.).

7398 (BONN-IR–91-38) **The LED monitoring system of the PHOENICS experiment.** Urban, D. Bonn Univ. (Germany). Physikalisches Inst.; Bonn Univ. (Germany). Mathematisch-Naturwissenschaftliche Fakultaet. Jul 1991. 52p. (In German). Order Number DE92758857. Source: OSTI; NTIS (US Sales Only); INIS.

The PHOENICS experiment at ELSA uses a LED monitoring system to control pulse height and time measurement with scintillation counters. A green LED is mounted at the light guide of each of the 304 involved photomultiplier tubes. The LEDs are driven by fast voltage pulses of 5 ns FWHM width and about 20 V amplitude. Simulation of single events is possible by computer controlled switching of individual LEDs. In order to correct for the temperature dependence of the LED intensity an automatic temperature recording system was coupled to the computer. This monitor system allows to control the pulse height and time measurement with an accuracy of about 2% and 100 ps respectively. (orig.).

7399 (BONN-IR–91-39) **Procedure for monitoring and calibration of the photon detection system of the SAPHIR spectrometer.** Guse, B. Bonn Univ. (Germany). Physikalisches Inst.; Bonn Univ. (Germany). Mathematisch-Naturwissenschaftliche Fakultaet. Jul 1991. 93p. (In German). Order Number DE92758914. Source: OSTI; NTIS (US Sales Only); INIS.

The SAPHIR detector at the ELSA storage ring of the Physics Institute of Bonn University is designed to measure multi-particle final states. The momenta of the charged particles are measured by a drift chamber system. Different types of particles are identified by their time of flight using a scintillation counter system. Photons are detected by a large area (16 m^2 in forward direction) shower counter arrangement. The shower counter system consisting of 98 modules is a metal-gas sandwich type which combines a good energy resolution (13.5% $1/\sqrt{E[GeV]}$) with a good spatial resolution (13 mm at 1 GeV). This paper describes the monitor system which has been built to measure and control the gas gain. Different methods are discussed. The gain is stabilized by using a system of small proportional tubes having the same geometry as those to be stabilized. These tubes are irradiated through a thin window by an ^{55}Fe source. The spectra are analysed by a computer program which detects gain drifts and compensates them by controlling the HV accordingly. A second measurement of the gas gain is performed using cosmic muons. Combining these two methods a stabilization of the detector pulse height better than 3% could be achieved. Cosmic muons have also been used to calibrate the single modules relative to each other. The last part of the paper describes a first absolute calibration of the shower counter system done in two different ways. First the e^+e^- pairs were used to calibrate the modules in the middle plain of the calorimeter. The second method exploited the decay photons of neutral pions. Both methods were found to yield consistent results. (orig.).

7400 (BONN-IR–91-43) **The data acquisition system PHON for the detectors of the PHOENICS experiment.** Schneider, W. Bonn Univ. (Germany). Physikalisches Inst.; Bonn Univ. (Germany). Mathematisch-Naturwissenschaftliche Fakultaet. Jul 1991. 70p. (In German). Order Number DE92759278. Source: OSTI; NTIS (US Sales Only); INIS.

The PHON data acquisition system for the PHOENICS experiment at the stretcher ring ELSA in Bonn and its development is described. PHON is based on a fast parallel CAMAC readout with VME front-end processors and a VAX/VMS computer, allowing c omfortable control and programming. The current configuration of the PHON system at the PHOENICS detector uses two CAMAC branches that are read out in parallel. The data is transferred to the VAX by either the ethernet (max. rate 100 kByte/sec) or a bus coupler device (max. rate 650 kByte/sec). On the VAX the data can be stored on a harddisk and analyzed by several PHON online tasks. The harddisk limits the maximum data rate to a value of approximately 180 kByte/sec. The maximum trigger rate achieved is about 150 Hz. Two kinds of user shells are realized to control the PHON system. A command shell follows the standard of the control language of the VMS operating system and a graphic user interface uses the 'X Window System'. The modular structure of the PHON system and the unique kind of creation of all PHON programs makes a further development of the system easy to do. (orig.).

7401 (BONN-IR--91-47) **Studies on the space-drift time relation in the inhomogeneous magnetic field in the planar drift chambers of the ZEUS detector.** Kirch, U. Bonn Univ. (Germany). Physikalisches Inst.; Bonn Univ. (Germany). Mathematisch-Naturwissenschaftliche Fakultaet. Aug 1991. 160p. (In German). Order Number DE92759282. Source: OSTI; NTIS (US Sales Only); INIS.

The ZEUS-detector at the electron-proton-collider HERA at DESY in Hamburg contains planar drift chambers (FTDs and RTD) in the proton forward and rear direction. These particle tracking devices will operate in a strong and highly inhomogeneous magnetic field (gradient up to 3 T/m), because they are located at both ends of the coil of the superconducting solenoid. The space drifttime relation (SDR) depends significantly on the relative configuration of the magnetic and electric field, i.e. it depends on the position of a track inside the chambers and on its angle of incidence. In this paper we study symmetries of the SDR throughout the chambers. We give a detailed description of the magnetic field measurements in the inner tracking region of the ZEUS-detector. We numerically study the effects of magnetic field measurement uncertainties on the SDR. In order to exploit the full spatial resolution of 100 μm, we need to know the field with an accuracy of 0.005 T in the regions of FTD1 and RTD and with 0.01 T in the regioins of FTD2 and FTD3. Finally we study a three dimensional parametrization of the SDR. We obtain a parametrization fullfilling the required criteria of accuracy, which allows a fast computation of the drift time as a function of the three basic parameters: the position of a track along the wire, the distance to the wire and the angle of incidence. (orig.).

7402 (BONN-IR--91-50) **Determination of the detection probability of neutron counters.** Harpes, N. Bonn Univ. (Germany). Physikalisches Inst.; Bonn Univ. (Germany). Mathematisch-Naturwissenschaftliche Fakultaet. 22 Jul 1991. 56p. (In German). Order Number DE92759277. Source: OSTI; NTIS (US Sales Only); INIS.

At the PHOENICS experiment neutron detection is done by scintillation counters consisting of 100x20x20 cm^3 NE110 or Nuplex3 bars with photomultiplier tubes mounted on both ends. Calibration measurements to determine the neutron detection efficiency have been done for 4 counters at the LNS (Laboratoire National Saturne, Saclay, France). The method to obtain neutrons of well-defined energy and angle was neutron-tagging in elastic np-scattering off a CH_2-target. The efficiency was measured at different impact positions and for up to five neutron energies between 20 and 175 MeV. The efficiency shows a strong energy dependence for low energies and becomes rather constant (ca. 20%) at higher energies. The detection thresholds were varied between 1.1 and 15 MeV. Especially for low energies, the detection efficiency depends strongly on the threshold. The results of Monte Carlo simulation are in good agreement with the measurements. (orig.).

7403 (BONN-IR--91-51) **Principal components analysis and polynomials as methods for the track extrapolation/interpolation for SAPHIR.** Juengst, H.G. Bonn Univ. (Germany). Physikalisches Inst.; Bonn Univ. (Germany). Mathematisch-Naturwissenschaftliche Fakultaet. Apr 1991. 92p. (In German). Order Number DE92759280. Source: OSTI; NTIS (US Sales Only); INIS.

A program to investigate the possibility of track extrapolation and interpolation for drift chambers with the Principal Components Analysis and polynoms was written for SAPHIR. The results for the most significant configurations at SAPHIR were pointed out. It was shown that the Principal Components Analysis is a good basis to write a fast track reconstruction program for a drift chamber using a global track model in an inhomogeneous magnetic field. A data input/output package was written, too. (orig.).

7404 (BONN-IR--91-53) **Studies on the intercalibration as well as construction and test of a gas-flow monitoring facility of the SAPHIR shower detector.** Ritz, B. Bonn Univ. (Germany). Physikalisches Inst.; Bonn Univ. (Germany). Mathematisch-Naturwissenschaftliche Fakultaet. Sep 1991. 69p. (In German). Order Number DE92759281. Source: OSTI; NTIS (US Sales Only); INIS.

At the SAPHIR detector a large electromagnetic calorimeter has been built to detect photons in forward direction. This photon detection system consists of 98 identical gas sampling calorimeters with signal wires perpendicular to the converters. For a single calorimeter module an energy resoltuion of $\sigma(E)/E^{*}\sqrt{E(GeV)}$ = 13.6% was achieved. Measurements to determine the relative calibration factors of the calorimeter channels have been made. To examine the influence of saturation effects on these factors, data of ionisation tracks directed parallel and perpendicular to the signal wires have been taken. The MOP algorithm is discussed as a possible method of finding a relevant physical quantity for the calculation of the calibration factors. The results of both measurements are compared. The second part of this paper describes the arrangement of the gas flow control of the photon detection system at SAPHIR. Each of nine gas flows can be selected by a special developed gas switch and is conducted to a thermic mass flow meter. There are 11 such gas switches. A computer takes control over the selection and the periodic measurements. The data are available at any time and give the experimentalist reliable information on the gas flow of all 98 calorimeter moduls. (orig.).

7405 (BONN-IR--91-59) **Construction and test of an apparatus for the measurement of the photon-definition probability at the SAPHIR experiment.** Hannappel, J. Bonn Univ. (Germany). Physikalisches Inst.; Bonn Univ. (Germany). Mathematisch-Naturwissenschaftliche Fakultaet. Oct 1991. 43p. (In German). Order Number DE92759317. Source: OSTI; NTIS (US Sales Only); INIS.

An apparatus for the measurement of the tagging efficiency P_γ for use with the SAPHIR-detector was built and tested together with it's readout and analysis software. Preliminary results show that a P_γ of 70% can be reached over the total tagged energy range, varying far more between adjacent channels than over the total energy range. Also some software was written to measure profiles of the electron and the photon beam at the SAPHIR-experiment. (orig.).

7406 (CNIC--00428) **Si(Li) X-ray detector.** Yuan Xianglin (Beijing Nuclear Instrument Factory, BJ (China)); Li Zhiyong; Hong Xiuse. China Nuclear Information Centre, Beijing, BJ (China). Aug 1990. 6p. (In Chinese). (BNIF--0004.). Order Number DE92613846. Source: OSTI; NTIS (US Sales Only); INIS.

The fabrication technology of the 10≈80 mm^2 Si(Li) X-ray detectors are described and some problems concerning technology and measurement are discussed. The specifications of the detectors are shown as well. The Si(Li) X-ray detector is a kind of low energy X-ray detectors. Owing to very high energy resolution, fine linearity and high detection efficiency in the range of low energy X-rays, it is widely used in the fields of nuclear physics, medicine, geology and environmental protection, etc,. It is also a kernel component for the scanning electron microscope and X-ray fluorescence analysis systems.

7407 (CONF-911107--49) **The Pulsed Interrogation Neutron and Gamma (PING) inspection system.** Schultz, F.J. (Oak Ridge National Lab., TN (United States)); Hensley, D.C.; Coffey, D.E.; Chapman, J.A.; Caylor, B.A.; Bailey, R.D.; Vourvopoulos, G.; Kehayias, J. Oak Ridge National Lab., TN (United States). [1991].

22p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Winter meeting of the American Nuclear Society (ANS); San Francisco, CA (United States); 10-15 Nov 1991. Order Number DE92004401. Source: OSTI; NTIS; GPO Dep.

Explosives and chemical warfare (CW) agents possess elements and characteristic elemental ratios not commonly found in significant quantities in other items. These elements include nitrogen, oxygen, fluorine, phosphorus, sulfur, and chlorine. The research described herein discusses the results to date of the development of a pulsed-neutron interrogation and gamma (γ)-ray system for detecting concealed explosives and for discriminating munitions containing CW agents and conventional explosives. Preliminary experimental data has suggested that distinct classes of chemical agents could also be distinguished, for example, nerve agents and mustard gases. Based on there results, the system is currently being designed for the detection of explosives concealed, for example, in airline luggage. Nuclear and x-ray technologies possess unique characteristics to quickly and reliably search for explosives. Both oxygen and nitrogen, present in sufficient concentrations, when detected, uniquely determine the presence of explosives. Carbon would be a third element that is common in all explosives, although it does not correlate uniquely with all known explosives. A system which identifies and quantifies all three elements would provide more reliable information about the interrogated material. We have previously demonstrated that the technique described in this paper can identify certain elements through fast- and slow-neutron interrogation and subsequent prompt- and delayed-γ-ray detection. The identification of CW agent elements such as chlorine, phosphorus, sulfur, and fluorine, is also accomplished through the detection of characteristic capture γ-rays. The Pulsed Interrogation Neutron and Gamma (PING) inspection system is based upon technology developed over twelve years for the determination of fissile mass quantities in radioactive waste, for the determination of sulfur in coal, and for in-vivo body composition measurements.

7408 (CONF-9105106–35) **DUMAND-II progress report.** Wilkes, R.J. DUMAND Collaboration. Washington Univ., Seattle, WA (United States). Visual Techniques Lab. [1991]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-91ER40614. (UWSEA-PUB–91-09). From Conference on the intersections between particle and nuclear physics; Tucson, AZ (United States); 23-29 May 1991. Order Number DE92004380. Source: OSTI; NTIS; INIS; GPO Dep.

The design, scientific goals, and capabilities of the DUMAND II detector system are described. Construction was authorized by DOE in 1990, and development of various detector subsystems is under way. Current plans include deployment of the shore cable, junction box and three strings of optical detector modules in 1992, with expansion to the full 9-string configuration about one year later.

7409 (CTH-RF–86) **The development of a spectrometer for 14 MeV neutrons from fusion.** Aronsson, D. Chalmers Univ. of Tech., Goeteborg (Sweden). Dept. of Reactor Physics. 1991. 40p. Order Number DE92615123. Source: OSTI; NTIS (US Sales Only); INIS.

A spectrometer for 14 MeV neutrons, to be used for fusion plasma diagnostics at JET, was developed. The spectrometer utilizes neutron scattering in a polyethylene foil with the detection of the scattered neutron and its associated recoil proton. For the detection of 12 MeV protons we have tested silicon surface barrier detectors, lithium-drifted silicon detectors and high purity germanium detectors. The lithium-drifted detectors were finally selected for use in the spectrometer. The lithium-drifted silicon diodes have also been used for direct spectrometry, utilizing the neutron induced charged particle reactions in silicon. The methods used for the energy calibration and the timing calibration of the diodes, both during the installation of the spectrometer and during operation, are described. The detection of 2 MeV neutrons is done by fast plastic scintillators. Since the neutron generator which was used to test the detectors supplies 14 MeV or 2.5 MeV neutrons only, a neutron energy converter has to be constructed to study the detectors at other neutron energies. In the actual spectrometer an array of scintillation neutron detectors is used. A method of calibrating such an array of detectors with a gamma source was elaborated and is also described here. The result of the calibration is a set of parameters than can be used to determine the high voltage settings and the discriminator levels that are needed to achieve homogeneous sensitivity for all the detectors of the array. The energy scale itself was then calibrated by using gamma sources of various energies. To test the spectrometer as a whole at a neutron generator, a test bed was constructed. A lithium-drifted silicon diode was used to measure the neutron flux and the neutron energy resolution in the test bed. (au).

7410 (DESY–91-083) **Plastic scintillators in magnetic fields.** Bloemker, D. (Hamburg Univ. (Germany). 1. Inst. fuer Experimentalphysik); Holm, U.; Klanner, R.; Krebs, B. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Jul 1991. 22p. Order Number DE92758918. Source: OSTI; NTIS (US Sales Only); INIS.

The dependence of the light yield and the transmission on magnetic field has been measured with different methods up to 0.45 T for the plastic scintillators NE-102A, SCSN-38, and Polivar. The scintillators were excited by 25 MeV protons, 5.9 keV X-rays and UV light. When excited with ionizing radiation an increase of light yield is observed. For SCSN-38 of 2.6 mm thickness it amounts to 0.3%, 0.9%, 1.1% and 3.3% at 1, 10, 100 and 450 mT, respectively. NE-102A behaves similar, whereas an acrylic scintillator shows a stronger field dependence. The effect is independent of the direction of the field but increases for the Polivar scintillator with its thickness. No change in the decay time of the scintillator has been observed. The response of the scintillators did not change when excited by UV light in a magnetic field. (orig.).

7411 (DOE/ER/10699–T10) **[Calorimeter based detectors for high energy hadron colliders]: [Progress report].** State Univ. of New York, Stony Brook, NY (United States). Dept. of Physics. [1991]. 57p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-80ER10699. Order Number DE92004331. Source: OSTI; NTIS; GPO Dep.

This report discusses the DO experiment; Central Tracking; Calorimetry; Test Beam studies; Analysis Efforts; Upgrading the DO Detector; The EMPACT/TEXAS and R&D; SSC Detector R&D; and SSC Detector Prospects.

7412 (DOE/ER/40257–6) **Non-accelerator particle physics: Final report, February 1, 1986–April 30, 1991.** Steinberg, R.I.; Lane, C.E. Drexel Univ., Philadelphia, PA (United States). Dept. of Physics. Aug 1991. 92p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-86ER40257. Order Number DE92004833. Source: OSTI; NTIS; INIS; GPO Dep.

The goals of this research were the experimental testing of fundamental theories of physics such as grand unification and the exploration of cosmic phenomena through the techniques of particle physics. We have worked on the MACRO experiment, which is employing a large area underground detector to search for grand unification magnetic monopoles and dark matter candidates and to study cosmic ray muons as well as low and high energy neutrinos; the νIMB project, which seeks to refurbish and upgrade the IMB water Cerenkov detector to perform an improved proton decay search together with a long baseline reactor neutrino oscillation experiments using a one kiloton liquid scintillator (the Perry experiment); and development of technology for improved liquid scintillators and for very low background materials in support of the MACRO and Perry experiments and for new solar neutrino experiments.

7413 (DOE/ER/40513–1) **Vectorization of GEANT for generic detector research and event simulation: Final report.** Martin, W.R. (Michigan Univ., Ann Arbor, MI (United States). Dept. of Nuclear Engineering); Wilderman, S.J.; Ball, R.C. Michigan Univ., Ann Arbor, MI (United States). Dept. of Nuclear Engineering. Mar 1991. 23p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-89ER40513. Order Number DE92004023. Source: OSTI; NTIS; INIS; GPO Dep.

The Monte Carlo method for particle transport simulation is an essential tool in both the design process and the analytical evaluation process for detectors in the current and coming generation of high energy physics (HEP) experiments. Currently, the GEANT [1] Monte Carlo shower simulation code is the primary research tool being used in modeling all aspects of particle transport in HEP detectors. As with most Monte Carlo programs, the effectiveness and range of applicability of GEANT is limited primarily by the excessive run time required to provide statistically reliable results. Since the number of tracks which must be simulated, and hence the computational effort required, increase dramatically as higher energy events are modeled, the need for increased computational speed will become more urgent as the HEP community continues to explore physics at ever increasing energies. Part of this need may be met by efficient utilization of the existing capabilities of current vector supercomputers, such as the Cray YMP/48 and the IBM 3090. Using such resources effectively with Monte Carlo programs involves alteration of the program from a scalar history based algorithm to a vectorized event based algorithm. Results of a preliminary evaluation of the suitability of GEANT for adaptation to a fully vectorizable event based algorithm are presented here. 22 refs., 5 figs.

7414 (DOE/ER/40675–1) **Exploitation of vertex detection at the Tevatron: Progress report.** Amidei, D.E. Michigan Univ., Ann Arbor, MI (United States). [1991]. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-91ER40675. Order Number DE92004075. Source: OSTI; NTIS; INIS; GPO Dep.

Short communication. FERMILAB COLLIDER DETECTOR; PROGRESS REPORT; FERMILAB TEVATRON; B MESONS; BEAM MONITORING

7415 (DOE/OR/00033–T464) **Producing a known neutral particle beam for the purpose of calibrating a neutral particle detector.** Lindley, R.A. Illinois Univ., Urbana, IL (United States). Dept. of Nuclear Engineering. 15 Aug 1989. 56p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-76OR00033. Order Number DE92004538. Source: OSTI; NTIS; INIS; GPO Dep.

On Earth, gravitational confinement of a plasma is not possible, so plasmas are studied in vacuum chambers where the confinement of the plasma consists mainly of the chamber walls and magnetic fields. Here, the interaction of the plasma with the walls around it is unavoidably significant. The energetic ions and electrons of the plasma strike the walls and a number of different particles leave the surface, most of which are electrically neutral. Sometimes, plasma-surface interactions are beneficial such an in plasma processing. In other cases, the plasma-surface interaction is a hindrance such as in magnetic fusion systems. In either case, it is important to study plasma-surface interactions in order to predict and control its effect on the experimental system. In an effort to understand the composition of the particles leaving the surface, Ph.D. candidate Bruce Cain and Associate Professor David Ruzjc at the University of Illinois have designed and built a system to examine the neutral particles scattered from light ions hitting a surface with a beam energy of 10 to 900 eV. According to the design of the system, the neutral particles are ionized by a glow discharge ionizer and then enter into an energy analyzer. In order to calibrate the ionizer and the energy analyzer, a known particle beam is made by a charge exchange cell that is placed in the path of an ion beam. The design and use of the charge exchange cell is the subject of this paper, which will present the underlying theory, followed by the experimental design, and finally the procedures and the results of the experiments undertaken.

7416 (EGG–10617-2103) **The effect of charge trapping on the spectrometric performance of HgI_2 gamma detectors.** Iwanczyk, J.S. (Xsirius, Inc., Marina Del Rey, CA (United States)); Schnepple, W.F.; Masterson, M.J. EG and G Energy Measurements, Inc., Goleta, CA (United States). 15 Oct 1991. 20p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC08-88NV10617. (CONF-9109209–3: 7. international workshop on room temperature - semiconductor X-ray and gamma-ray detectors and associated electronics, Ravello (Italy), 23-28 Sep 1991). Order Number DE92003688. Source: OSTI; NTIS; INIS; GPO Dep.

The paper presents a theoretical model to describe the charge collection process for HgI_2 gamma detectors. The standard deviations of full energy peak distributions are shown as a function of mean drift lengths of electron and holes. Calculated spectra shape changes versus variation in the internal detector electrical field distribution are studied. Simulated spectra are compared wit experimental data. The model assumptions and results are discussed. 18 refs., 4 figs.

7417 (FNAL/C–91/205) **Three-dimensional field map of the Fermilab D0 detector.** Ostiguy, J.; Yamada, R. Fermi National Accelerator Lab., Batavia, IL (United States). Aug 1991. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-910505–428: 1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC), San Francisco, CA (United States), 6-11 May 1991). Order Number DE92004804. Source: OSTI; NTIS; INIS; GPO Dep.

The D0 detector is a general purpose hadron collider detector presently under construction at Fermilab and scheduled to be put in operation in the fall of 1991. The D0 muon detection system is composed of three major toroids referred to respectively as the Central Field (CF) toroid and the End Field (EF) toroids. The complete detector weighs in excess of 4000 metric tons and rests on a steel platform. The muon detection system was designed using standard 2D codes and flux maps inside were obtained for each of the toroids taken separately. Various magnetic field measurements were performed; discrepancies with the design calculations have been observed and attributed to three dimensional effects. In this paper, we compare the predictions of the 2D computations to 3D calculations for a fully assembled detector. We also estimate the electromagnetic forces between the toroids and discuss other 3D effects, in particular, the effect of the supporting platform. 4 refs., 3 figs.

7418 (FNAL/C–91/297) **The Fermilab D0 Master Clock System.** Rotolo, C.; Fachin, M.; Chappa, S.; Rauch, M.; Needles, C.; Dyer, A. Fermi National Accelerator Lab., Batavia, IL (United States). Nov 1991. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-911106–38: IEEE nuclear science symposium, Santa Fe, NM (United States), 5-9 Nov 1991). Order Number DE92004120. Source: OSTI; NTIS; INIS; GPO Dep.

The Clock System provides bunch crossing related timing signals to various detector subsystems. Accelerator synchronization and monitoring as well as timing signal generation and distribution are discussed. The system is built using three module types implemented in Eurostandard hardware with a VME communications interface. The first two types of modules are used to facilitate synchronization with the accelerator and to generate 23 timing signals that are programmable with one RF bucket (18.8 ns) resolution and 1 ns accuracy. Fifty-four of the third module type are used to distribute the timing signals and two synchronous 53 MHz and 106 MHz clocks to various detector subsystems. 6 refs., 5 figs.

7419 (FNAL/C–91/302) **Status of the silicon strip high-rate FASTBUS readout system.** Gonzalez, H.; Barsotti, E.; Bowden, M.; Christian, D.; Chramowicz, J.; Fachin, M.; Haldeman, M.; Hoff, J.; Holmes, S.; Rotolo, C.; Romero, A.; Slimmer, D.; Swoboda, C.; Trendler, R.; Urish, J.; Yarema, R.; Zimmerman, T.; Zimmermann, S.; Kowald, W.; MacManuFermi National Accelerator Lab., Batavia, IL (United States). Nov 1991. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-911106–37: IEEE nuclear science symposium, Santa Fe, NM (United States), 5-9 Nov 1991). Order Number DE92004121. Source: OSTI; NTIS; INIS; GPO Dep.

Our new readout system was developed in collaboration with, and largely to the specification of, the E771 experimenters. E771 is a fixed target experiment designed to study the production of B hadrons by an 800 GeV/c proton beam. The experiment will operate at rates of up to 200 million beam protons per second and 10 million interactions per second. The experimental apparatus will consist of an open geometry magnetic spectrometer featuring good muon and electron identification (much of which was used in E705), and a compact 16000 channel Silicon Strip Detector. In order to satisfy the experimenter's desire to instrument 16000 SSD elements in a package only 5 cm wide, 5 cm high, and 21 cm deep, and in order to meet the performance specifications, we have made extensive use of "Application Specific Integrated Circuits" (ASIC's).

7420 (FNAL/C–91/314) **Performance and system flexibility of the CDF Hardware Event Builder.** Shaw, T.M. (Fermi National

Accelerator Lab., Batavia, IL (United States)); Schurecht, K.; Sinervo, P. Fermi National Accelerator Lab., Batavia, IL (United States). Nov 1991. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-911106–49: IEEE nuclear science symposium, Santa Fe, NM (United States), 5-9 Nov 1991). Order Number DE92004806. Source: OSTI; NTIS; INIS; GPO Dep.

The CDF Hardware Event Builder [1] is a flexible system which is built from a combination of three different 68020-based single width Fastbus modules. The system may contain as few as three boards or as many as fifteen, depending on the specific application. Functionally, the boards receive a command to read out the raw event data from a set of Fastbus based data buffers ("scanners"), reformat data and then write the data to a Level 3 trigger/processing farm which will decide to throw the event away or to write it to tape. The data acquisition system at CDF will utilize two nine board systems which will allow an event rate of up to 35 Hz into the Level 3 trigger. This paper will present detailed performance factors, system and individual board architecture, and possible system configurations.

7421 (FNAL/C–91/315) **Commissioning of the control and data acquisition electronics for the CDF Silicon Vertex Detector.** Tkaczyk, S.M. (Fermi National Accelerator Lab., Batavia, IL (United States)); Turner, K.J.; Nelson, C.A.; Shaw, T.M.; Wesson, T.R.; Bailey, M.W.; Kruse, M.C.; Castro, A. Fermi National Accelerator Lab., Batavia, IL (United States). Nov 1991. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-911106–46: IEEE nuclear science symposium, Santa Fe, NM (United States), 5-9 Nov 1991). Order Number DE92004809. Source: OSTI; NTIS; INIS; GPO Dep.

The SVX data acquisition system includes three components: a Fastbus Sequencer, an SVX Rabbit Crate Controller and a Digitizer. These modules are integrated into the CDF DAQ system and operate the readout chips. The results of the extensive functional tests of the SVX modules are reported. We discuss the stability of the Sequencers, systematic differences between them and methods of synchronization with the Tevatron beam crossings. The Digitizer ADC calibration procedure run on the microsequencer is described. The microsequencer code used for data taking and SVX chip calibration modes is described. Measurements of the SVX data scan time are discussed.

7422 (FNAL/C–91-316) **Software development tools for the CDF MX scanner.** Stuermer, W.; Turner, K.; Littleton-Sestini, S. Fermi National Accelerator Lab., Batavia, IL (United States). Nov 1991. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-911106–48: IEEE nuclear science symposium, Santa Fe, NM (United States), 5-9 Nov 1991). Order Number DE92004807. Source: OSTI; NTIS; INIS; GPO Dep.

This paper discuses the design of the high level assembler and diagnostic control program developed for the MX, a high speed, custom designed computer used in the CDF data acquisition system at Fermilab. These programs provide a friendly productive environment for the development of software on the MX. Details of their implementation and special features, and some of the lessons learned during their development are included.

7423 (FNAL/C–91/317) **Control and data acquisition electronics for the CDF Silicon Vertex Detector.** Turner, K.J.; Nelson, C.A.; Shaw, T.M.; Wesson, T.R. Fermi National Accelerator Lab., Batavia, IL (United States). Nov 1991. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-911106–39: IEEE nuclear science symposium, Santa Fe, NM (United States), 5-9 Nov 1991). Order Number DE92004119. Source: OSTI; NTIS; INIS; GPO Dep.

A control and data acquisition system has been designed for the CDF Silicon Vertex Detector (SVX) at Fermilab. The system controls the operation of the SVX Rev D integrated circuit (SVX IC) that is used to instrument a 46,000 microstrip silicon detector. The system consists of a Fastbus Sequencer, a Crate Controller and Digitizer modules. 11 refs., 6 figs., 3 tabs.

7424 (FNAL/C–91/319) **The upgraded CDF front end electronics for calorimetry.** Drake, G.; Frei, D.; Hahn, S.R.; Nelson, C.A.; Segler, S.L.; Stuermer, W. Fermi National Accelerator Lab., Batavia, IL (United States). Nov 1991. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-911106–50: IEEE nuclear science symposium, Santa Fe, NM (United States), 5-9 Nov 1991). Order Number DE92004805. Source: OSTI; NTIS; INIS; GPO Dep.

The front end electronics used in the calorimetry of the CDF detector has been upgraded to meet system requirements for higher expected luminosity. A fast digitizer utilizing a 2 μSec, 16 bit ADC has been designed and built. Improvements to the front end trigger circuitry have been implemented, including the production of 900 new front end modules. Operational experience with the previous system is presented, with discussion of the problems and performance goals.

7425 (FNAL/C–91/320) **System software design for the CDF Silicon Vertex Detector.** Tkaczyk, S. (Fermi National Accelerator Lab., Batavia, IL (United States)); Bailey, M. Fermi National Accelerator Lab., Batavia, IL (United States). Nov 1991. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-911106–47: IEEE nuclear science symposium, Santa Fe, NM (United States), 5-9 Nov 1991). Order Number DE92004808. Source: OSTI; NTIS; INIS; GPO Dep.

An automated system for testing and performance evaluation of the CDF Silicon Vertex Detector (SVX) data acquisition electronics is described. The SVX data acquisition chain includes the Fastbus Sequencer and the Rabbit Crate Controller and Digitizers. The Sequencer is a programmable device for which we developed a high level assembly language. Diagnostic, calibration and data acquisition programs have been developed. A distributed software package was developed in order to operate the modules. The package includes programs written in assembly and Fortran languages that are executed concurrently on the SVX Sequencer modules and either a microvax or an SSP. Test software was included to assist technical personnel during the production and maintenance of the modules. Details of the design of different components of the package are reported.

7426 (FNAL-TM–1765) **A combination drift chamber/pad chamber for very high readout rates.** Spiegel, L. (Fermi National Accelerator Lab., Batavia, IL (United States)); Cataldi, G.; Elia, V.; Mazur, P.; Murphy, C.T.; Smith, R.P.; Yang, W.; Alexopoulos, T.; Durandet, C.; Erwin, A.; Jennings, J.; Antoniazzi, L.; Introzzi, G.; Lanza, A.; Liguori, G.;Fermi National Accelerator Lab., Batavia, IL (United States). Nov 1991. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. Order Number DE92004754. Source: OSTI; NTIS; INIS; GPO Dep.

Six medium-sized ($\approx 1 \times 2$ m^2) drift chambers with pad and stripe readout have been constructed for and are presently operating in Fermi National Accelerator Laboratory experiment E-771. Each chamber module actually represents a pair of identical planes: two sets of anode wires, two sets of stripes, and two sets of pads. The wire planes are read out separately and represent X measurements in the coordinate system of the experiment. The twin stripe and pad planes are internally paired within the chamber modules; stripe signals represent Y measurements and pad signals combination X and Y measurements. Signals which develop on the stripes and pads are mirror (but inverted) images of what is seen on the wires. In addition to being used in the off-line pattern recognition, pad signals are also used as inputs to an on-line high transverse momentum (pt) trigger processor. While the techniques involved in the design and construction of the chambers are not novel, they may be of interest to experiments contemplating very large area, high rate chambers for future spectrometers.

7427 (FNAL-TM–1766) **"Massless gaps" for solenoid + calorimeter.** Marraffino, J.; Wu, W.; Beretvas, A.; Green, D.; Denisenko, K.; Para, A. Fermi National Accelerator Lab., Batavia, IL (United States). Nov 1991. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. Order Number DE92006750. Source: OSTI; NTIS; INIS; GPO Dep.

The necessary existence of material in front of the first active element in a calorimeter will degrade the performance of that device. The question is by what factor. The follow up question is what can be done to minimize the damage. These questions are usually of primary importance for liquid argon calorimetry because of the necessity of containment dewars. However, the problem is universal.

For example, the Solenoid Detector Collaboration, SDC, has proposed a superconducting coil which would be placed in front of the EM calorimeter. Although much effort has been made to minimize the depth of material in the coil, still the resolution and linearity must be optimized if the SDC goal of precision electromagnetic (EM) calorimetry is to be realized.

7428 (IAEA-TECDOC-619) **X-ray and gamma-ray standards for detector calibration.** International Atomic Energy Agency, Vienna (Austria). Sep 1991. 157p. Order Number DE92615125. Source: OSTI; NTIS (US Sales Only); INIS.

The IAEA established a Co-ordinated Research Programme (CRP) on the Measurements and Evaluation of X- and Gamma-Ray Standards for Detector Efficiency Calibration in 1986 with the aim of alleviating the generation of such discrepancies. Within the framework of this CRP, representatives of nine research groups from six Member States and one international organization performed a number of precise measurements and systematic in-depth evaluations of the required decay data. They have also contributed to the development of evaluation methodology and measurement techniques, and stimulated a number of such studies at laboratories not directly involved in the IAEA project. The results of the work of the CRP, which was finished in 1990, are presented in this report. Recommended values of half-lives and photon emission probabilities are given for a carefully selected set of radionuclides that are suitable for detector efficiency calibration (X-rays from 5 to 90 keV and gamma-rays from 30 to about 3000 keV). Detector efficiency calibration for higher gamma-ray energies (up to 14 MeV) is also considered. The evaluation procedures used to obtain the recommended values and their estimated uncertainties are reported, and a summary of the remaining discrepancies is given. Refs and tabs.

7429 (INDC(EGY)-006/L) **A low background pulsed neutron polyenergetic beam at the ET-RR-1 reactor.** Adib, M. (Atomic Energy Establishment, Cairo (Egypt). Reactor and Neutron Physics Dept.); Abdel-Kawy, A.; Habib, N.; Abu-El-Ela, M.; Wahba, M.; Kilany, M. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Dec 1991. 10p. Project EGY/1/016. Order Number DE92615126. Source: OSTI; NTIS (US Sales Only); INIS.

A low background pulsed neutron polyenergetic thermal beam at ET-RR-1 is produced by a rotor and rotating collimator suspended in magnetic fields. Each of them is mounted on its mobile platform and whose centres are 66 cm apart, rotating synchronously at speeds up to 16000 rpm. It was found that the neutron burst produced by the rotor with almost 100% transmission passes through the collimator, when the rotation phase between them is 28.8 deg. Moreover the background level achieved at the detector position is low, constant and free from peaks due to gamma rays and fast neutrons accompanying the reactor thermal beam. (author). 12 refs, 3 figs.

7430 (INIS-BR-2883, pp. 2) **Corrections of dose response non-linearity in film dosimetry.** Sibata, C.H. (Metro Health Medical Center, Cleveland, OH (United States). Dept. of Radiology); Mota, H.C. Associacao Brasileira de Fisicos em Medicina, Rio de Janeiro, RJ (Brazil). 1990. 61p. (CONF-9010386-: 12. Brazilian Congress on Biomedical Engineering and 5. Latin American Conference on Medical Physics, Ribeirao Preto (Brazil), 7-11 Oct 1990). In *Proceedings of the 5. Latin American Meeting on Medical Physics; 2. Workshop on Medical Physics; 1. Workshop on Medical Physics and Biomedical Engineering.* Order Number DE92613627. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. FILM DOSIMETRY/dose-response relationships; FILM DOSIMETRY/nonlinear problems; ALGORITHMS; IMAGES; RADIATION DOSES; THERAPY

7431 (INIS-BR-2883, pp. 3) **Electron paramagnetic resonance using the alanine amino acid.** Alexandre, A.C. (Universidade Estadual de Campinas, SP (Brazil). Centro de Engenharia Biomedica); Nascimento, O.R.; Baffa Filho, O. Associacao Brasileira de Fisicos em Medicina, Rio de Janeiro, RJ (Brazil). 1990. 61p. (In Spanish). (CONF-9010386-: 12. Brazilian Congress on Biomedical Engineering and 5. Latin American Conference on Medical Physics, Ribeirao Preto (Brazil), 7-11 Oct 1990). In *Proceedings of the 5. Latin American Meeting on Medical Physics; 2. Workshop on Medical Physics; 1. Workshop on Medical Physics and Biomedical Engineering.* Order Number DE92613627. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. DOSEMETERS/alanines; DOSEMETERS/electron spin resonance; DOSEMETERS; ALANINES; SPECIFICATIONS

7432 (INIS-BR-2883, pp. 4) **Dosimetric and radiological aspects related to radioisotope production at the cyclotron laboratory of IEN, Brazil.** Fajardo, P.W. (Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil)); Santos, I.H.T.; Antunes, L.J. Associacao Brasileira de Fisicos em Medicina, Rio de Janeiro, RJ (Brazil). 1990. 61p. (CONF-9010386-: 12. Brazilian Congress on Biomedical Engineering and 5. Latin American Conference on Medical Physics, Ribeirao Preto (Brazil), 7-11 Oct 1990). In *Proceedings of the 5. Latin American Meeting on Medical Physics; 2. Workshop on Medical Physics; 1. Workshop on Medical Physics and Biomedical Engineering.* Order Number DE92613627. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. RADIOISOTOPES/production; RADIOISOTOPES/radiation protection; BRAZILIAN CNEN; CYCLOTRONS; DOSE EQUIVALENTS; GAMMA SPECTROSCOPY; PERSONNEL MONITORING; RADIOISOTOPES; PRODUCTION

7433 (INIS-BR-2883, pp. 4) **Neutron dosimetry.** Fratin, L. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Cruz, M.T. da. Associacao Brasileira de Fisicos em Medicina, Rio de Janeiro, RJ (Brazil). 1990. 61p. (In Portuguese). (CONF-9010386-: 12. Brazilian Congress on Biomedical Engineering and 5. Latin American Conference on Medical Physics, Ribeirao Preto (Brazil), 7-11 Oct 1990). In *Proceedings of the 5. Latin American Meeting on Medical Physics; 2. Workshop on Medical Physics; 1. Workshop on Medical Physics and Biomedical Engineering.* Order Number DE92613627. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. NEUTRON MONITORS/calibration; CALIBRATION

7434 (INIS-BR-2883, pp. 8) **An electrometer for dosimetric use.** Bruco, J.L. (Sao Paulo Univ., Ribeirao Preto, SP (Brazil). Faculdade de Filosofia, Ciencias e Letras); Pela, C.A.; Ghilardi, A.J.P.; Ghilardi Neto, T. Associacao Brasileira de Fisicos em Medicina, Rio de Janeiro, RJ (Brazil). 1990. 61p. (In Portuguese). (CONF-9010386-: 12. Brazilian Congress on Biomedical Engineering and 5. Latin American Conference on Medical Physics, Ribeirao Preto (Brazil), 7-11 Oct 1990). In *Proceedings of the 5. Latin American Meeting on Medical Physics; 2. Workshop on Medical Physics; 1. Workshop on Medical Physics and Biomedical Engineering.* Order Number DE92613627. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ELECTROMETERS/dosimetry; ELECTROMETERS; DOSIMETRY; SPECIFICATIONS

7435 (INIS-BR-2883, pp. 11) **Comparative study of several TLDs responses for beta dosimetry.** Ferrari, V.A. (Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia); Freitas, L.C. de. Associacao Brasileira de Fisicos em Medicina, Rio de Janeiro, RJ (Brazil). 1990. 61p. (In Portuguese). (CONF-9010386-: 12. Brazilian Congress on Biomedical Engineering and 5. Latin American Conference on Medical Physics, Ribeirao Preto (Brazil), 7-11 Oct 1990). In *Proceedings of the 5. Latin American Meeting on Medical Physics; 2. Workshop on Medical Physics; 1. Workshop on Medical Physics and Biomedical Engineering.* Order Number DE92613627. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. THERMOLUMINESCENT DOSEMETERS/beta dosimetry; TESTING

7436 (INIS-BR-2883, pp. 11) **Water solid simulator.** Arguiropulo, M.Y. (Sao Paulo Univ., Ribeirao Preto, SP (Brazil). Faculdade de Filosofia, Ciencias e Letras); Ghilardi Neto, T. Associacao Brasileira de Fisicos em Medicina, Rio de Janeiro, RJ (Brazil). 1990. 61p. (In Portuguese). (CONF-9010386-: 12. Brazilian Congress on Biomedical Engineering and 5. Latin American Conference on Medical Physics, Ribeirao Preto (Brazil), 7-11 Oct 1990). In *Proceedings of the 5. Latin American Meeting on Medical Physics; 2. Workshop on Medical Physics; 1. Workshop on Medical*

Physics and Biomedical Engineering. Order Number DE92613627. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. PHANTOMS/dosimetry; PHANTOMS/water; PHANTOMS; DOSIMETRY; WATER; RADIOTHERAPY

7437 (INIS-BR–2883, pp. 11) **Characterization of a detector base on semiconductor for using in beams of x-ray till 100kv.** Silva, M.F. da (Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia); Freitas, L.C. de. Associacao Brasileira de Fisicos em Medicina, Rio de Janeiro, RJ (Brazil). 1990. 61p. (In Portuguese). (CONF-9010386–: 12. Brazilian Congress on Biomedical Engineering and 5. Latin American Conference on Medical Physics, Ribeirao Preto (Brazil), 7-11 Oct 1990). In *Proceedings of the 5. Latin American Meeting on Medical Physics; 2. Workshop on Medical Physics; 1. Workshop on Medical Physics and Biomedical Engineering.* Order Number DE92613627. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. PHOTODIODES/testing; PHOTODIODES; TESTING

7438 (INIS-mf–13026, pp. 341-342) **Development of indigenous Wilkinson type ADCs (50/100 MHz).** Misra, V.M. (Bhabha Atomic Research Centre, Bombay (India). Computer Div.); Nadane, A.A.; Geetha, V.; Mahajan, M.D.; Rajput, L.S. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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7439 (INIS-mf–13026, pp. 325-326) **Use of multidetector telescope system for improving particle identification in heavy ion reactions.** Mythili, S. (Bhabha Atomic Research Centre, Bombay (India). Nuclear Physics Div.); Roy, B.J.; Charagi, S.K.; Srikantiah, R.V.; Betigeri, M.G.; Gupta, S.K.; Badiger, N.G. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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7440 (INIS-mf–13026, pp. 327-328) **An experimental technique for the study of heavy ions in the cosmos.** Sharma, A.P. (Aligarh Muslim Univ. (India). Dept. of Physics). Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. COSMIC RADIATION/trans 104 elements; DIELECTRIC TRACK DETECTORS/heavy ions; DIELECTRIC TRACK DETECTORS/trans 104 elements; TRANS 104 ELEMENTS/meteorites; ACCELERATORS; ANNEALING; CALIBRATION; ION DETECTION; LENGTH; OLIVINE; PARTICLE TRACKS; METEORITES

7441 (INIS-mf–13026, pp. 329-330) **Simplified relations for the calculations of energy loss rate and range of heavy ions in phosphate and quartz glass detectors.** Kumar, Shyam (Kurukshetra Univ. (India). Dept. of Physics); Sharma, S.K.; Sharma, A.P. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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7442 (INIS-mf–13026, pp. 337-338) **Contribution of pair production process to the efficiency of Ge detectors.** Sudarshan, M. (North East Hill Univ., Shillong (India). Dept. of Physics); Singh, R. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. 5 refs. GAMMA DETECTION/efficiency; LI-DRIFTED GE DETECTORS/efficiency; EFFICIENCY; GAMMA RADIATION; KEV RANGE 100-1000; MEV RANGE 01-10; PAIR PRODUCTION

7443 (Juel–2420) **An induction drift chamber with flash ADC selection.** Steinkamp, O. Forschungszentrum Juelich GmbH (Germany). Inst. fuer Kernphysik. Jan 1991. 125p. (In German). Order Number DE92750199. Source: OSTI; NTIS (US Sales Only); INIS.

The induction drift chamber is a unique type of detector in that it combines high spatial resolution ($\simeq$ 25 μm for vertical tracks) and rate tolerance ($\simeq 10^6 e^-/(cm^2 s)$) with a low mass per unit length. The angular dependence can be limited to $\leq$ 0.5 μm/1deg with suitable gases. A multilevel test chamber was constructed and tested with minimum-ionisation electrodes. It was shown that stable operation of a non-symmetrical IDC is possible with cathode spacing of 0.5 mm and 3.0 mm, and that the FADC selection permits the resolution of the time structure of the signals and yields consistent results. (orig./DG).

7444 (Juel–2440) **New components for the neutron spectrometer SV5c at the 10H channel of the research reactor FRJ2.** Stockmeyer, R. Forschungszentrum Juelich GmbH (Germany). Inst. fuer Festkoerperforschung. Feb 1991. 36p. (In German). Order Number DE92758893. Source: OSTI; NTIS (US Sales Only); INIS.

The following new components have been installed at the neutron time-of-flight spectrometer SV5c: 1. Monochromator with devices for tilting and rotating 10 crystal. The fine-adjustment of the crystal orientation can be done with a computer program which maximizes the neutron intensity at the sample position. 2. 128 x 512 multi-channel time-of-flight electronic 3. Computerized equipment for measuring thermal properties of a sample (adsorption isotherm, sample transmission) 4. Data aquisition, data handling and experiment control software coded in ASYST. (orig.).

7445 (KEK–90-25(v.2), pp. 937-942) **Scintillation detector system in neutron-nucleus experiments.** Shimizu, H.M. (Kyoto Univ. (Japan). Dept. of Physics); Adachi, T.; Masuda, Y. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 532p. Order Number DE92713961. Source: OSTI; NTIS (US Sales Only); INIS.

The very large enhancement of parity nonconservation (PNC) effect in neutron-nucleus reaction has been studied for a decade. The enhancement of the PNC effect has an interesting point, namely the mechanism of enhancement is expected also for time reversal symmetry breaking terms. The longitudinal asymmetry in (n, gamma) reaction cross sections has been studied for several nuclei. Very large enhancement with magnitude up to 10^6 has been observed in the radiative capture p-wave resonance of La-139 at the incident neutron energy of 0.734 eV. In the experiment, capture gamma ray and transmitted neutrons were counted as a function of the neutron energy using the time of flight method. The gamma ray detection takes an advantage to identify the radiative capture reaction, while the neutron transmission includes the large contribution of neutron scattering. In this report, the current experimental arrangement and the recent results are described. The experiment was carried out in a polarized neutron beam line at KENS. The counters, the measurement of the longitudinal asymmetry and the development for exclusive gamma ray detection are reported. (K.I.).

7446 (KEK-PROC–91-5) **Radiation detectors and their uses: Proceedings of the sixth workshop on radiation detectors and their uses.** Miyajima, M.; Sasaki, S. (eds.). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jul 1991. 168p. (CONF-9101129–: 6. workshop on radiation detectors and their uses, Tsukuba (Japan), 29-30 Jan 1991). Order Number DE92751035. Source: OSTI; NTIS (US Sales Only); INIS.

This issue is the collection of the papers presented at the title meeting. The 18 of the presented papers are indexed individually. (J.P.N.).

7447 (LA-UR–91-3489) **Warhead counting using neutron scintillators: Detector development, testing, and demonstration.** Byrd, R.C.; Auchampaugh, G.F.; Moss, C.E.; Feldman, W.C. Los Alamos National Lab., NM (United States). [1991]. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-911106–18: IEEE nuclear science symposium, Santa Fe, NM (United States), 5-9 Nov 1991). Order Number DE92003798. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Although the number of warheads on a missile can be determined relatively simply by a scan of the emitted gamma radiation, this approach may be considered too intrusive because of the possibility of revealing high-resolution energy or position information. Neutron spectra are nearly featureless, and obtaining the position resolution needed to reveal warhead details would be very difficult. We describe the development of a fast-neutron detector based on a boron-loaded plastic scintillator used previously for space applications. The detector rejects gammas and scattered low-energy neutrons, and its segmentation allows narrow fan-shaped collimation within ±20° horizontally and ±50° vertically. Testing includes distinguishing between mockups with either two or three warheads and locating the ten warheads on a silo-based Peacekeeper missile. 2 refs., 13 figs.

7448 (LA-UR–91-3514) **Detection of uranium-based nuclear weapons using neutron-induced fission.** Moss, C.E. (Los Alamos National Lab., NM (United States)); Byrd, R.C.; Feldman, W.C.; Auchampaugh, G.F.; Estes, G.P.; Ewing, R.I.; Marlow, K.W. Los Alamos National Lab., NM (United States). [1991]. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36 ;AC04-76DP00789. (CONF-911106–30: IEEE nuclear science symposium, Santa Fe, NM (United States), 5-9 Nov 1991). Order Number DE92003865. Source: OSTI; NTIS; INIS; GPO Dep.

Although plutonium-based nuclear weapons can usually be detected by their spontaneous emission of neutrons and gammas, the radiation emitted by weapons based entirely on highly-enriched uranium can often be easily shielded. Verification of a treaty that limits the number of such weapons may require an active technique, such as interrogating the suspect assembly with an external neutron source and measuring the number of fission neutrons produced. Difficulties include distinguishing between source and fission neutrons, the variations in yield for different materials and geometries, and the possibility of non-nuclear weapons that may contain significant amounts of fissionable depleted uranium. We describe simple measurements that test the induced-fission technique using an isotopic Am-Li source, an novel energy-sensitive neutron detector, and several small assemblies containing ^{235}U, ^{238}U, lead, and polyethylene. In all cases studied, the neutron yields above the source energy are larger for the ^{235}U assemblies than for assemblies containing only lead or depleted uranium. For more complex geometries, corrections for source transmission may be necessary. The results are promising enough to recommend further experiments and calculations using examples of realistic nuclear and non-nuclear weapons. 5 refs., 11 figs.

7449 (LA-UR–91-3553) **The vertex detector for the Lepton/Photon Collaboration.** Sullivan, J.P.; Boissevain, J.G.; Fox, D.; van Hecke, H.; Jacak, B.V.; Kapustinsky, J.S.; Leitch, M.J.; McGaughey, P.L.; Moss, J.M.; Sondheim, W.E. Los Alamos National Lab., NM (United States). [1991]. 30p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-9110232–2: Symposium on Relativistic Heavy Ion Collider (RHIC) detector R&D, Upton, NY (United States), 10-11 Oct 1991). Order Number DE92005021. Source: OSTI; NTIS; INIS; GPO Dep.

The conceptual design of the vertex detector for the Lepton/Photon Collaboration at RHIC is described, including simulations of its expected performance. The design consists of two concentric layers of single-sided Si strips. The expected performance as a multiplicity detector and in measuring the pseudo-rapidity η distribution is discussed as well as the expected vertex finding efficiency and accuracy. Various options which could be used to reduce the cost of the detector are also discussed.

7450 (LA-UR–91-3657) **Simulations of a spectral gamma-ray logging tool response to a surface source distribution on the borehole wall.** Wilson, R.D. (Highland Scientific Ltd., Ashland, OR (United States)); Conaway, J.G. Los Alamos National Lab., NM (United States). [1991]. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-911106–16: IEEE nuclear science symposium, Santa Fe, NM (United States), 5-9 Nov 1991). Order Number DE92003727. Source: OSTI; NTIS; INIS; GPO Dep.

We have developed Monte Carlo and discrete ordinates simulation models for the large-detector spectral gamma-ray (SGR) logging tool in use at the Nevada Test Site. Application of the simulation models produced spectra for source layers on the borehole wall, either from potassium-bearing mudcakes or from plate-out of radon daughter products. Simulations show that the shape and magnitude of gamma-ray spectra from sources distributed on the borehole wall depend on radial position with in the air-filled borehole as well as on hole diameter. No such dependence is observed for sources uniformly distributed in the formation. In addition, sources on the borehole wall produce anisotropic angular fluxes at the higher scattered energies and at the source energy. These differences in borehole effects and in angular flux are important to the process of correcting SGR logs for the presence of potassium mudcakes; they also suggest a technique for distinguishing between spectral contributions from formation sources and sources on the borehole wall. These results imply the existence of a standoff effect not present for spectra measured in air-filled boreholes from formation sources. 5 refs., 11 figs.

7451 (LA-UR–91-3871) **Applications of the LAHET simulation code to relativistic heavy ion detectors.** Waters, L.S.; Gavron, A. Los Alamos National Lab., NM (United States). [1991]. 13p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract W-7405-ENG-36. (CONF-9110232–3: Symposium on Relativistic Heavy Ion Collider (RHIC) detector R&D, Upton, NY (United States), 10-11 Oct 1991). Order Number DE92005016. Source: OSTI; NTIS; INIS; GPO Dep.

The Los Alamos High Energy Transport (LAHET) simulation code has been applied to test beam data from the lead/scintillator Participant Calorimeter of BNL AGS experiment E814. The LAHET code treats hadronic interactions with the LANL version of the Oak Ridge code HETC. LAHET has now been expanded to handle hadrons with kinetic energies greater than 5 GeV with the FLUKA code, while HETC is used exclusively below 2.0 GeV. FLUKA is phased in linearly between 2.0 and 5.0 GeV. Transport of electrons and photons is done with EGS4, and an interface to the Los Alamos HMCNP3B library based code is provided to analyze neutrons with kinetic energies less than 20 MeV. Excellent agreement is found between the test data and simulation, and results for 2.46 GeV/c protons and pions are illustrated in this article.

7452 (LBL–30606) **Amorphous Ge bipolar blocking contacts on Ge detectors.** Luke, P.N.; Cork, C.P.; Madden, N.W.; Rossington, C.S.; Wesela, M.F. Lawrence Berkeley Lab., CA (United States). Oct 1991. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-911106–45: IEEE nuclear science symposium, Santa Fe, NM (United States), 5-9 Nov 1991). Order Number DE92004094. Source: OSTI; NTIS; INIS; GPO Dep.

Semiconductor nuclear radiation detectors are usually operated in a full depletion mode and blocking contacts are required to maintain low leakage currents and high electric fields for charge collection. Blocking contacts on Ge detectors typically consist of n-type contacts formed by lithium diffusion and p-type contacts formed by boron ion implantation. Electrical contacts formed using sputtered amorphous Ge (a-Ge) films on high-purity Ge crystals were found to exhibit good blocking behavior in both polarities with low leakage currents. The a-Ge contacts have thin dead layers associated with them and can be used in place of lithium-diffused, ion-implanted or Schottky barrier contacts on Ge radiation detectors. Multi-electrode detectors can be fabricated with very simple processing steps using these contacts. 12 refs.

7453 (LBL–31383) **Enhanced columnar structure in CsI layer by substrate patterning.** Jing, T. (Lawrence Berkeley Lab., CA (United States)); Cho, G.; Drewery, J.; Kaplan, S.N.; Mireshghi, A.; Perez-Mendez, V.; Wildermuth, D.; Fujieda, I. Lawrence Berkeley Lab., CA (United States). Oct 1991. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-911106–44: IEEE nuclear science symposium, Santa Fe, NM (United States), 5-9 Nov 1991). Order Number DE92004099. Source: OSTI; NTIS; INIS; GPO Dep.

Columnar structure in evaporated CsI layers can be controlled by patterning substrates as well as varying evaporation conditions. Mesh-patterned substrates with various dimensions were created by spin-coating polyimide on glass or amorphous silicon substrates and defining patterns with standard photolithography technique. CsI(Tl) layers 200–1000 μm were evaporated. Scintillation properties of these evaporated layers, such as light yield and speed, were equivalent to those of the source materials. Spatial resolution of X-ray detectors consisting of these layers and a linear array of X-ray detectors consisting of these layers and a linear array of Si photodiodes was evaluated by exposing them to a 25μm narrow beam of X-ray. The results obtained with 200μm thick CsI layers coupled to a linear photodiode array with 20 dots/mm resolution showed that the spatial resolution of CsI(Tl) evaporated on patterned substrates was about 75 μm FWHM, whereas that on CsI(Tl) on flat substrates was about 230 μm FWHM. Micrographs taken by SEM revealed that these layers retained the well-defined columnar structure originating from substrate patterns. Adhesion and light transmission of CsI(Tl) were also improved by patterning the substrate.

7454 (LBL–31415) **Noise in a-Si:H p-i-n detector diodes.** Cho, G.; Qureshi, S.; Drewery, J.S.; Jing, T.; Kaplan, S.N.; Lee, H.; Mireshghi, A.; Perez-Mendez, V.; Wildermuth, D. Lawrence Berkeley Lab., CA (United States). Oct 1991. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-911106–42: IEEE nuclear science symposium, Santa Fe, NM (United States), 5-9 Nov 1991). Order Number DE92004172. Source: OSTI; NTIS; INIS; GPO Dep.

Noise of a-Si:H p-i-n diodes ($5 \sim 50$ μm thick) under reverse bias was investigated. The current dependent 1/f type noise was found to be the main noise component at high bias. At low bias the thermal noise from a series resistance of the p-layer and of the metallic contacts is the dominant noise source which is unrelated to the reverse current through the diode. The noise associated with the p-layer resistance decreased significantly on annealing under reverse bias, reducing the total zero bias noise by a factor 2 approximately. The noise recovered to the original value on subsequent annealing without bias. In addition to the resistive noise there seems to be a shaping time independent noise component at zero biased diodes.

7455 (MPE–225) **Diffusion and drift of charges in semiconductor detectors.** Meidinger, N. Max-Planck-Institut fuer Physik und Astrophysik, Garching (Germany). Inst. fuer Extraterrestrische Physik; Technische Univ. Muenchen, Garching (Germany). Fakultaet fuer Physik. Jan 1991. 73p. (In German). Order Number DE92758917. Source: OSTI; NTIS (US Sales Only); INIS.

For this analysis, a fully depleteable pn-CCD (a novel, energy and local resolution semiconductor using the drift chamber principle) has been tested for verification at different temperatures, photon energies, and drift times, including theoretical calculations. Experimental results are in good agreement with calculated data, and deviations ($\leq$11%) have been understood to an extent that proposals can be made for improving the accuracy. Charge splitting has been found to be reduced in the case of reduced charge collecting areas, i.e. for example at lower temperatures, or with shorter drift times. This effect is also reduced in the case of larger charge collecting areas (pixels). With the given topology of the cell structure, the charge splitting can be much more strongly suppressed as compared to other X-ray CCD design types. (orig.).

7456 (NIKHEF-H–91-11) **The Honeycomb Strip Chamber: The application in LHC/SSC experiments and the test results of a prototype.** Graaf, Harry van der (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H); Buskens, Joop; Rewiersma, Paul; Faber, Gerard; Koenig, Adriaan; Wijnen, Thei. Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H. Jun 1991. 33p. Order Number DE92613872. Source: OSTI; NTIS (US Sales Only); INIS.

The Honeycomb Strip Chamber (HSC) is a new position sensitive detector. It consists of a stack of folded foils, forming a rigid honeycomb structure. In the centre of each hexagonal cell a wire is strung. Conducting strips on the foils, perpendicular to the wires, pick up the induced avalanche charge. Test results of a prototype show that processing the signals form three adjacent strips nearest to the track gives a spatial resolution better than 64 μm for perpendicular incident tracks. The chamber performance is only slightly affected by a magnetic field. (author). 25 refs.; 21 figs.

7457 (NIKHEF-H–91-14) **The Micro Trench Gas Counter: A novel approach to high luminosity tracking in HEP.** Schmitz, J. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H). Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H. Jul 1991. 14p. Order Number DE92613878. Source: OSTI; NTIS (US Sales Only); INIS.

A novel design is presented for a gas avalanche chamber with micro-strip gas readout. While existing gaseous microstrip detectors (Micro-strip Gas Counters, Knife edge chambers) have a minimum anode pitch of the order of 100 μm, the pitch of the discussed Micro Trench Gas Counter goes down to 30-50 μm. This leads to a better position resolution and two track separation, and a higher radiation resistivity. Its efficiency and signal speed are expected to be the same as the Microstrip Gas Counter. The energy resolution of the device is expected to be equal to or better than 10 percent for the ^{55}Fe peak. Since the anode strip dimensions are larger than those in a MSGC, the device may be not as sensitive to discharges and mechanical damage. In this report production of the device is briefly described, and predictions on its operation are made based on electric field calculations and experience with the Microstrip Gas Counter. The authors restrict themselves to the application in High Energy Physics. (author). 10 refs.; 9 figs.

7458 (NIKHEF-H–91-21) **Optimization of the microstrip gas counter.** Geijsberts, M.H.J. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H); Hartjes, F.G.; Pannekoek, J.G.; Schmitz, J.; Udo, F. Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H. Aug 1991. 14p. (CONF-9105263–: 5. Pisa meeting on advanced detectors, Isola d'Elba (Italy), 26-31 May 1991). Order Number DE92613879. Source: OSTI; NTIS (US Sales Only); INIS.

A study has been made to optimize the characteristics of the micro-strip gas counter for use as a tracer at the LHC. In this framework the authors found that two of the most important design parameters of the detector are given by the choice of the counter gas and the width of the gas gap. In this report the authors deduce, using measurements done with a UV laser and a particle beam, two most suited mixtures which consist of xenon, di-methyl-ether and CO_2. Also the optimum width of the gas gap is derived. Here an efficient tagging will be possible at the LHC frequency. (author). 8 refs.; 6 figs.

7459 (NIKHEF-H–91-23) **Tests of the performance of different gas mixtures in microstrip gas counters.** Geijsberts, M. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H); Hartjes, F.G.; Pannekoek, J.G.; Schmitz, J.; Udo, F. Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H. Sep 1991. 24p. Order Number DE92613880. Source: OSTI; NTIS (US Sales Only); INIS.

This article describes measurements of the electron drift and diffusion parameters in gas mixtures, suited for application in a micro-strip gas counter. The aims were to optimize for position resolution, detection efficiency and response time. The measurements were done in mixtures of Ar, CF_4, C_2H_6, Xe, CO_2 and DME using a pulsed UV laser beam. Results are reported from tests in a particle beam for efficiency and position resolution of the counter using the two gases found to be most promising in the laser tests. (author). 6 refs.; 15 figs.; 1 tab.

7460 **Improved ionization chamber dosimeter.** Renner, T.R.; Nyman, M.A.; Stradtner, R. To Dept. of Energy. 1990. Filed date 16 Apr 1990. USA Patent patent application 7-509,121. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE92003876. Source: OSTI; NTIS; GPO Dep.

This invention is comprised of a method for fabricating an ion chamber dosimeter collecting array of the type utilizing plural discrete elements formed on a uniform collecting surface which includes forming a thin insulating layer over an aperture in a frame having surfaces, forming a predetermined pattern of through holes in the layer, plating both surfaces of the layer and simultaneously tilting and rotating the frame for uniform plate-through of the holes between surfaces. Aligned masking and patterned etching of the surfaces provides interconnects between the through holes and copper leads provided to external circuitry.

7461 **X-ray imaging system.** Sommargren, G.E.; Weaver, H.J. To Dept. of Energy. 1990. Filed date 30 Apr 1990. USA Patent patent application 7-516,401. 20p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. Order Number DE92003830. Source: OSTI; NTIS; GPO Dep.

The invention provides a method and apparatus for focusing and imaging x-rays. An opaque sphere is used as a diffractive imaging element to diffract x-rays from an object so that the divergent x-ray wavefronts are transformed into convergent wavefronts and are brought to focus to form an image of the object with a large depth of field. 6 figs.

7462 **Real time Faraday spectrometer.** Smith, T.E. Jr.; Struve, K.W.; Colella, N.J. To Dept. of Energy. 1990. Filed date 30 Apr 1990. USA Patent patent application 7-516,402. 23p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE92004608. Source: OSTI; NTIS; GPO Dep.

This invention is comprised of a charged particle spectrometer that contains a detection system which embodies the benefits of both foil-light emissions and faraday cups, yet it does not interfere with the particle beam. 5 Figs. (GHH)

7463 **A circuit for monitoring electric currents produced by a twin bridge calorimeter.** Donohoue, T.P.; Oertal, C.P.; Tyree, W.H.; Valdez, J.L. To Dept. of Energy. 1990. Filed date 19 Jun 1990. USA Patent patent application 7-540,240. 14p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC34-90DP62349. Order Number DE92003811. Source: OSTI; NTIS; GPO Dep.

A circuit for measuring temperature differentials in a calorimeter is disclosed. The temperature differential between the reference element and sample element containing a radioactive material is measured via a wheatstone bridge arrangement of thermistors. The bridge is driven with an alternating current on a pulsed basis to maintain the thermal floor of the calorimeter at a low reference value. A lock-in amplifier connected to the bridge phase locks a signal from the bridge to the input pulsed AC signal to provide a DC voltage. The DC voltage is sampled over time and provided to a digital computer. The digital computer, using curve fitting algorithms, will derive a function for the sample data. From the function, an equilibrium value for the temperature may be calculated. 4 figs.

7464 **Punchcode reader system for dosimeters.** Langsted, J.M. To Dept. of Energy. 1990. Filed date 31 Jul 1990. USA Patent patent application 7-560,667. 31p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC34-90DP62349. Order Number DE92003828. Source: OSTI; NTIS; GPO Dep.

A punchcode reader is provided for reading data encoded in a punchcode hole array on a dosimeter. The dosimeter falls through a passage in the reader containing photosensor detectors disposed along the passage which provide output signals to a microprocessor. The signals are processed to determine the orientation of the dosimeter in the reader, the location and state of punchcode holes in a two row array thereby decoding the encoded data. Multiple rate of fall calculations are made, and if appropriate matching of the punchcode array is not obtained in three tries, an error signal is outputted to the operator. The punchcode reader also provides for storage of data from multiple dosimeters passed through the reader, and for the output of decoded data to an external display or a computer for further processing. 2 figs.

7465 (PCCF-RI–90-16) **A dilepton spectrometer project for SIS.** Roche, G. Clermont-Ferrand-2 Univ., 63 - Aubiere (France). Lab. de Physique Corpusculaire. 1990. 6p. (CONF-9011256–: 4. Journees des theoriciens Saturne on Dilepton production in nucleon-nucleon and nucleon-nucleus collisions at relativistic energies, Saclay (France), 22-23 Nov 1990). Order Number DE92733612. Source: OSTI; NTIS (US Sales Only).

No abstract available. Published in summary form only. 4 figs.

7466 (PNL–7600-Pt.1, pp. 65-69) **Aerosol technology development.** James, A.C. Pacific Northwest Lab., Richland, WA (United States). Jun 1991. In *Pacific Northwest Laboratory annual report for 1990 to the DOE Office of Energy Research. Part 1, Biomedical sciences.* 151p. Order Number DE91015807. Source: OSTI; NTIS.

The purpose of this project is to develop and transfer aerosol technology to basic and applied research in biology and chemistry, especially in the areas of health and environmental effects of energy-related materials. The ongoing objective is to improve systems for the control, monitoring, and characterization of exposures of laboratory animals to toxic aerosols, gases, and vapors. The current thrust is to improve the metrology, control, and characterization of exposures to radon progeny in studies of the mechanisms of radon-induced respiratory tract cancer and to provide a new and simpler technique to characterize exposure to unattached radon progeny in domestic or occupational settings. The authors report here the design and development of an Unattached Radon Progeny Size-Spectrometer to measure the concentration and unattached fraction of potential alpha energy in air and also the activity-size distribution of the unattached progeny.

7467 (SAND–91-2451C) **Segmentation of x-ray images using Probabilistic Relaxation Labeling.** Thai, T.Q. Sandia National Labs., Albuquerque, NM (United States). [1991]. 13p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9111129–2: FAA explosives detection symposium, Atlantic City, NJ (United States), 13-15 Nov 1991). Order Number DE92002988. Source: OSTI; NTIS; GPO Dep.

Segmentation is a process of separating objects of interest from their background or from other objects in an image. Without a suitable segmentation scheme, it is very difficult to detect contraband in X-rays images. In this paper, a Probabilistic Relaxation Labeling (PRL) segmentation scheme is presented and compared with other segmentation methods. PRL segmentation is an interative algorithm that labels each pixel in an image by cooperative use of two information sources: the pixel probability and the degree of certainty of its probability supported by the neighboring pixels. The practical implementation and results of the PRL segmentation on X-ray baggage images are also discussed and compared with other segmentation methods. 13 refs., 12 figs.

7468 (SLAC-PUB–5642-Rev.) **Progress and commissioning of the SLD Cherenkov Ring Imaging Detector: Revision.** Abe, K. (Tohoku Univ., Sendai (Japan). Dept. of Physics); Hasegawa, K.; Suekane, F.; Yuta, H.; Antilogus, P.; Aston, D.; Bienz, T.; Bird, F.; Dasu, S.; Dolinsky, S.; Dunwoodie, W.; Hallewell, G.: Kawahara, H.; Kwon, Y.; Leith, D.W.G.S.; Muller, D.; Nagamin-Stanford Univ., CA (United States). Nov 1991. 2p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-910881–6-Rev.: Particles and fields '91, Vancouver (Canada), 18-22 Aug 1991). Order Number DE92004947. Source: OSTI; NTIS; INIS; GPO Dep.

We report the recent progress of the SLD Cherenkov Ring Imaging Detector. All of the individual components of the device (TPC's, mirrors, liquid radiator trays) have been completed and installed.

Almost half of the electronics packages are installed and operational, and the data acquisition system has been commissioned. The liquid C_6F_{14} recirculation system is functioning. The drift gas supply systems are operating well with TMAE, and the gaseous Freon C_5F_{12} recirculator is being brought on-line. Our monitor and control systems are fully functional. The commissioning of all 40 TPCs at full operating voltage has gone very smoothly. The system shows a remarkable immunity to the SLC backgrounds, and yields very clean events, while operating with a single electron sensitivity.

7469 (SLAC-PUB-5678) **Large acceptance magnetic spectrometers for polarized deep inelastic electron scattering.** Petratos, G.G.; Eisele, R.L.; Gearhart, R.A.; Hughes, E.W.; Young, C.C. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Oct 1991. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-911106-51: IEEE nuclear science symposium, Santa Fe, NM (United States), 5-9 Nov 1991). Order Number DE92004948. Source: OSTI; NTIS; INIS; GPO Dep.

The design of two magnetic spectrometers for the measurement of the spin-dependent structure function g_1^n of the neutron and a test of the Bjorken sum rule is described. The measurement will consist of scattering 23 GeV polarized electrons off a polarized ^{3}He target and detecting scattered electrons of 7 to 18 GeV at 4.5° and 7°. Each spectrometer is based on two large aperture dipole magnets bending in opposite directions. This "reverse" deflection design doubles the solid angle as compared to the conventional design of same direction bends used in previous experiments. Proper choice of the deflection angles and the distance between the two dipoles in each spectrometer allows background photons from radiative processes to reach the detectors only after at least two bounces off the spectrometer vacuum walls, resulting in an expected tolerable background. Each spectrometer is equipped with a pair of Cerenkov detectors, a pair of scintillation hodoscopes and a lead-glass shower calorimeter providing electron and pion identification with angular and momentum resolutions sufficient for the experimental measurement. 7 refs., 8 figs., 1 tab.

7470 (UCRL-CR-108465) **X-ray optics for plasma diagnostics: Final report, October 1, 1988–January 1, 1991.** Knight, L.V. (Brigham Young Univ., Provo, UT (United States)). Lawrence Livermore National Lab., CA (United States); Brigham Young Univ., Provo, UT (United States). Aug 1991. 12p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE92003967. Source: OSTI; NTIS; GPO Dep.

This report summarizes the work performed by Brigham Young University (BYU) while under contract with the Advanced X-ray Optics Program (AXOP) at Lawrence Livermore National Laboratory (LLNL) from October 1988 to January 1991. The main accomplishments were in the areas of characterization of x-ray optical components, upgrading AXOP's X-ray CCD camera, and completing an initial design study for a high-energy (10 KeV) x-ray microscope. Progress in each of these areas is described below. 10 figs.

7471 (UCRL-ID-108489) **Muon drift chamber physics and engineering R and D activities for the L* and GEM Detectors in FY 1991.** Ables, E.; Bionta, R.M.; Britt, H.C.; Capell, M.; Chargin, A.K.; Deis, G.A.; Fackler, O.D.; Johnson, C.V. III; Lowry, M.E.; Makowiecki, D.M.; Masquelier, D.A.; McCammon, K.; McConaghy, C.F.; Olson, H.E.; Schmitt, E.H.; Skulina, K.M.; Vital, R.L.; Wenaus, TLawrence Livermore National Lab., CA (United States). 25 Sep 1991. 68p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE92004624. Source: OSTI; NTIS; GPO Dep.

Lawrence Livermore National Laboratory (LLNL) joined the multinational L* Detector collaboration in early 1990. The L* Detector has been described in great detail in a number of documents submitted to the Superconducting Super Collider (SSC) Laboratory. LLNL's participation in the L* collaboration consisted of a multidisciplinary effort involving a number of physicists, engineers and technologists from different areas of the laboratory who came together to identify areas of research, development and engineering on the L* Detector where LLNL's expertise and technological capabilities could best be utilized. Among these capabilities, superconducting magnet technology, chemistry and materials science, and design of new types of physics detectors were deemed areas of LLNL expertise best suited to the R&D effort needed for L*. This paper will describe the work carried out at LLNL on muon chamber R&D for the L* detector in FY 1991. Because of the L* proposal rejection in May 1991, and the subsequent restructuring to form the GEM detector collaboration in July 1991, the work described in this paper will also be seen to the applicable to the envisioned muon chamber subsystem for GEM.

7472 (UCRL-ID-108736) **Argon SDC detector cryogenic design.** Slack, D.S. Lawrence Livermore National Lab., CA (United States). 25 Oct 1991. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE92004470. Source: OSTI; NTIS; GPO Dep.

A first cut at designing the cryogenic systems is resented. The point design or sample design presented includes flow-rate calculations, piping sizes, dewar elevations, etc. In summary, the analysis shows argon cooling is ample even with relatively small piping, headers, dewar elevations, etc. This will afford the designer considerable latitude to change the design as required to meet other system requirements. For example, dewar elevation above the detector and horizontal distance to the detector could be varied to meet hall-space requirements. The point design shows a simple system with only one argon supply-and-return pipe to the detector. No nitrogen cooling is required at the detector. No seals or piping (except for an open supply and return header) are required in the detector and a minimum, of baffling to director argon flow is required. No thermal insulation is required to protect modules from pre-amp heat. A simple temperature control technique for the argon loop using a single nitrogen dewar and heat exchanger is shown.

7473 (USIP-91-02) **Exploratory study for a solid-state charged-particle spectrometer inside the celsius ring: $\alpha + {}^1H$ reactions at 1.7 and 2.2 GeV/c.** Bargholtz, C.; Fransson, K.; Holmberg, L.; Lindh, K.; Sandberg, L.; Tegner, P.E.; Thoerngren-Engblom, P.; Vojdani, D. Stockholm Univ. (Sweden). Inst. of Physics. Aug 1991. 30p. Order Number DE92613881. Source: OSTI; NTIS (US Sales Only); INIS.

Charged particles emitted in the extreme forward direction can be detected in a particle telescope mounted inside the CELSIUS ring in one of the dipole magnets following the target. Results of a test with a plastic scintillator telescope are reported for $\alpha + H$ reactions at 1.7 and 2.2 GeV/c. The results are consistent with ray-trace calculations. Contributions in the spectrometer from background reactions and scattering in the beam tube are small. (au).

4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

Refer also to citation(s) 6391

7474 (INIS-mf-14017) **Annealing of radiation damages in extrinsic semiconductor detectors with lead chalkogenide diode lasers. Final report.** Schiessl, U.P.; Tacke, M. Fraunhofer-Institut fuer Physikalische Messtechnik (IPM), Freiburg im Breisgau (Germany); Bundesministerium fuer Forschung und Technologie, Bonn (Germany). 1991 59p. (In German). Contract BMFT 511/DARA;BMFT 01RS89376. Order Number DE92750130. Source: OSTI; NTIS (US Sales Only); INIS.

Highly sensitive, extrinsic semiconductor detectors are used at cryogenic temperatures in infrared satellite telescopes for astronomical applications. Calibration and sensitivity of the detectors are changed by high-energy radiation in the earth orbit. Conventional annealing methods either induce high electric power dissipation or do not anneal all detectors uniformly and reliably. The research project had the task of proving the annealing of radiation damage with the aid of a novel optical method that on the one hand is expected to involve low power dissipation and on the other hand achieves a reliable annealing of all detectors. The detector to be annealed is irradiated with the IR radiation of a lead chalkogenide laser diode. Annealing could be proved successfully in especially critical detectors with low losses. On the basis of the achieved results, the technique can be developed to prototype maturity within the framework of a successor project. (orig.) With 5 refs., 17 tabs., 29 figs.

7475 (SAND–91-2705C) **Radiation compensated optically-triggered GaAs and Si thyristor switches.** Carson, R.F. Sandia National Labs., Albuquerque, NM (United States). [1991]. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-920367–1: Department of Defense (DOD) fiber optics conference, McLean, VA (United States), 25 Mar 1992). Order Number DE92003950. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Optically-triggered thyristors are hardened to switching in high dose-rate transient x-ray environments by adding compensating photodetectors that are shielded from the light signal but are sensitive to ionizing radiation. Silicon thyristors are packaged with compensating photodiodes that reduce sensitivity to premature switching by transient radiation by a factor of 100. GaAs devices are monolithically integrated with a photo-transistor and are resistant to radiation-induced switching (or "upset") up to 2×10^9 [Rad (Si)/(sec)]. This is a factor of 10 increase in tolerance to upset over uncompensated two-terminal GaAs thyristors. 7 refs.

4404 Well Logging Instrumentation

7476 **Downhole hydraulic seismic generator.** Gregory, D.L.; Hardee, H.C.; Smallwood, D.O. To Dept. of Energy. 1990. Filed date 19 Apr 1990. USA Patent patent application 7-511,372. 21p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE92004602. Source: OSTI; NTIS; GPO Dep.

A downhole hydraulic seismic generator system for transmitting energy wave vibrations into earth strata surrounding a borehole. The system contains an elongated, unitary housing operably connected to a well head aboveground by support and electrical cabling, and contains clamping apparatus for selectively clamping the housing to the walls of the borehole. The system further comprises a hydraulic oscillator containing a double-actuating piston whose movement is controlled by an electro-servovalve regulating a high pressure hydraulic fluid flow into and out of upper and lower chambers surrounding the piston. The spent hydraulic fluid from the hydraulic oscillator is stored and pumped back into the system to provide high pressure fluid for conducting another run at the same, or a different location within the borehole. 4 figs.

4405 Thermal Instrumentation

Refer also to citation(s) 7463

7477 (Juel–2455) **Investigations for the suitability of photoelectrical aerosol sensors (PAS) as an instrument of the on-line and in-situ monitoring of combustion aerosols containing polycyclic aromatic hydrocarbon (PAH) and nitropolycyclic aromatic hydrocarbon (NPAH).** Zajc, A. Forschungszentrum Juelich GmbH (Germany). Inst. fuer Chemische Technologie; Dortmund Univ. (Germany). Mar 1991. 105p. (In German). Order Number DE92758870. Source: OSTI; NTIS (US Sales Only).

The principle applicability of the Photoelectrical Aerosol Sensors (PAS) for on-line and in-situ detection of Polycyclic Aromatic Hydrocarbon (PAH) and Nitropolycyclic Aeomatic Hydrocarbon (NPAH) was proven in a laboratory fluidized bed combustion. In this case, statistically assured investigations could be performed with dodecane and heating fuel oil EL. For the combustion of waste oil, the results could solely be made for two measuring points on a secure statistical basis. Hence, indication could therefore be made that the sensor signal represents a function of the PAH emissions even in this extremely complex matrix. These investigations can, however, not verify the linear dependancy of the PAS signal from the PAH emissions during the combustion of waste oil. This linear relation can be assumed, however, based on the results in regard to the combustion of doecane and fuel oil EL, even for waste oil. (orig./BBR).

7478 (MLM–3714(OP)) **Heat distribution error in radiometric calorimeters.** Strohm, W.W. (EG and G Mound Applied Technologies, Miamisburg, OH (United States)); Perry, R.B. EG and G Mound Applied Technologies, Miamisburg, OH (United States). [1991]. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-88DP43495. (CONF-910901–26: 4. international conference on facility operations/safeguards interface, Albuquerque, NM (United States), 29 Sep - 4 oct 1991). Order Number DE92004008. Source: OSTI; NTIS; GPO Dep.

Calorimetric assay of plutonium and tritium is an important and well characterized measurement. The discussion of heat distribution error for radiometric calorimeters in relevant consensus standards is adequate for existing water bath calorimeters since they have a relatively flat response profile throughout the sample chamber. The development of transportable dry calorimeters has resulted in instruments with response profiles showing larger variations. This work describes the approach used to determine the heat distribution error term in the error models for two transportable dry calorimeters and recommends that this approach be used for all radiometric calorimeters and included in appropriate consensus standards. 7 refs.

7479 (MLM–3725(OP)) **Field test results of the dry heat exchanger calorimeter at LANL.** Wetzel, J.R. (EG and G Mound Applied Technologies, Miamisburg, OH (United States)); Renz, D.P.; James, S.J.; Duff, M.F.; Cremers, T.; Camp, K. EG and G Mound Applied Technologies, Miamisburg, OH (United States); Los Alamos National Lab., NM (United States). [1991]. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-88DP43495. (CONF-910901–25: 4. international conference on facility operations/safeguards interface, Albuquerque, NM (United States), 29 Sep - 4 oct 1991). Order Number DE92004007. Source: OSTI; NTIS; GPO Dep.

The Dry Heat Exchanger Calorimeter System was developed by Mound as a calorimeter system that requires no water. The Los Alamos National Laboratory (LANAL) conducted a field test of the calorimeter system from November 1990 through February 1991. The results of this field test and a discussion of these results are presented here. The calorimeter system was tested with a variety of reference standards and actual samples, and the results were compared to the assay results of an existing water bath calorimeter at LANL. The standards were assayed with an average error of 0.20% and a standard deviation of 1.0%; whereas, the samples were assayed with an average error of 0.12% and a standard deviation of 0.8%. These results are in agreement with the results obtained during the Mound testing. 1 ref.

7480 **Triaxial thermopile array geo-heat-flow sensor.** Carrigan, C.R.; Hardee, H.C.; Reynolds, G.D.; Steinfort, T.D. To Dept. of Energy. 1990. Filed date 30 Apr 1990. USA Patent patent application 7-516,399. 18p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE92004606. Source: OSTI; NTIS; GPO Dep.

A triaxial thermopile array geothermal heat flow sensor is designed to measure heat flow in three dimensions in a reconstituted or unperturbed subsurface regime. Heat flow can be measured in conductive or permeable convective media. The sensor may be encased in protective pvc tubing and includes a plurality of thermistors and an array of heat flow transducers produce voltage proportional to heat flux along the subsurface regime and permit direct measurement of heat flow in the subsurface regime. The presence of the thermistor array permits a comparison to be made between the heat flow estimates obtained from the transducers and heat flow calculated using temperature differences and Fourier's Law. The device is extremely sensitive with an accuracy of less than 0.1 Heat Flow Units (HFU) and may be used for long term readings. 6 figs.

4406 Optical Instrumentation

Refer also to citation(s) 7291, 7500, 7508, 7513, 8135, 8193, 8419, 8446

7481 (DOE/ER/14045–5) **Microcomputer enhanced optical investigation of spreading and evaporative processes in ultra thin films: Progress report, January 1, 1991–December 31, 1991.** Wayner, P.C. Jr.; Liu, A.H. Rensselaer Polytechnic Inst., Troy, NY (United States). Dec 1991. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-89ER14045. Order Number DE92005085. Source: OSTI; NTIS; GPO Dep.

The general objective of the research is to determine the heat transfer characteristics of evaporating ultra-thin films. The immediate objective is to develop a microscopic image-processing system (IPS) to measure the film thickness profile. The IPS has two parts: an image analyzing interferometer (IAI) and an image analyzing ellipsometer (IAE). An IAI was designed and used to measure the thickness profiles of an extended meniscus in the contact line region of completely wetting liquid films. Both steady state and oscillating menisci were studied. We find that the convenience and efficiency of mirocomputer enhanced video microscopy naturally leads to a better understanding of the transport processes in the contact line region. We also find that the processes of change-of-phase heat transfer and fluid flow in thin films are intrinsically connected because of their common dependence on the intermolecular force field. The design of an image analyzing ellipsometer (IAE) was completed and the system was successfully tested by measuring the thickness and refractive index profiles of various solid films of known thicknesses. The profile of draining isothermal films will be measured next.

7482 (DOE/ER/60925–T1) **Skeletal remodeling dynamics: New approaches with imaging instrumentation.** Parks, N.J.; Pinkerton, K.E.; Seibert, J.A.; Pool, R.R. California Univ., Davis, CA (United States). [1991]. 19p. Sponsored by U.S. DOE Energy Research. DOE Contract FG03-90ER60925. Order Number DE92003752. Source: OSTI; NTIS; INIS; GPO Dep.

This report of progress and future objectives timetable is based on an included schematic of goals and objectives and the project abstract which is included as Appendix 1. Five matters are summarized in the order of (1) novel methods of calcified bone confocal microscopy and reconstruction image analysis of decalcified beagle and human cortical bone serial sections, (2) macroscopic cross-correlation of beagle and human cortical and cancellous bone fractions with CT analysis, (3) guidance to the most radiobiologically important skeletal regions of interest with the just completed ^{90}Sr bone tumor map from life time beagle studies, (4) deposition patterns of radioactive agents that participate in apatite crystal nucleation processes in bone and leave radiation-excited electrons trapped in bone mineral, and (5) the budget period timetable. The discovery that beta particles from ^{166}Ho ($T_{\frac{1}{2}}$ =26 hr, β_{max} = 1.8 MeV) phosphonic acid bone agents leave detectable, long-lived, electron paramagnetic resonance signals in bone is included in Appendix 2 as a joint report.

7483 (DOE/ER/61085–1) **[Nanometer scale exciton spectroscopy and photochemistry: Dynamic imaging of DNA structure-activity relations and radiation signatures]: Progress report, September 24, 1990–July 24, 1991.** Kopelman, R. Michigan Univ., Ann Arbor, MI (United States). [1991]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-90ER61085. Order Number DE92004016. Source: OSTI; NTIS; GPO Dep.

We have constructed a scanning near-field optical microscope. For this we developed subwavelength micropipette light sources containing photostable crystal tips. We have also developed a technique for pulling and metal coating for single mode optical fibers to give nanometer silica tips emitting polarized laser light. Clear images have been obtained of polymeric porous membranes with nanometer pore sizes of comparable quality to that of scanning electron microscopy, but without the need for a vacuum. This method is aimed at both transmission and fluorescence nanoscopy. We believe that at least one of these will be operational in the coming year. We have also made significant progress on the next stage: Scanning, Tunneling, Exciton Microscopy. This is based on direct energy transfer between the tip and the particular molecule or fluorophore in the sample. We expect this stage to be operational in the third year of the project. Preliminary near-field optical scans indicate our resolution is already in the nanometer range. 3 figs. (MHB)

7484 (ENEA-RT-AMB–90-47) **Single particle laser light scattering analyzer: Simulated performance.** Neri, E.; Mazzacurati, V.; Platini, M. ENEA, Casaccia (Italy). Area Energia, Ambiente e Salute; Rome Univ. (Italy). Dipt. di Fisica. Jun 1991. 14p. (RT/AMB–90-47). Order Number DE92744022. Source: OSTI; NTIS (US Sales Only).

This paper presents a laser light scattering apparatus which measures the physical characteristics of a filter testing aerosol in its actual flow by analyzing simultaneously the intensity of the light scattered at different angles by each particle passing through an optically defined scattering volume. Both size and refractive index may be obtained provided that the incoming light flux is kept constant, within 15%, inside the scattering volume. The complete simulation of the optical apparatus was performed by supposing that only one particle at a time is analyzed and that the particles are spherical, thus allowing the Mie theory to model their scattering behaviour. Particle size, complex refractive index (real and imaginary part), and light flux incident onto the particle were considered as the four variables. Preliminary trial runs, performed with the aim of determining the minimum number of collecting angles necessary to obtain the convergence of fitting procedure to the expected values of the unknown parameters, showed that this convergence could be only occasionally obtained even if up to 10 collecting angles had been adopted. This occurrence demonstrated the existence of a strong correlation between the four parameters. Subsequent runs performed for non-conductive materials gave, on the contrary, better results.

7485 (ENEA-RT-INN–90-52) **Optical cell for variable temperature molecular spectroscopic measurement.** Baldacchini, G.; Bellatreccia, A.; Cardoni, P.; Cenciarelli, I.; D'Amato, F.; Giovagnoli, R.; Baltussen, J. ENEA, Frascati (Italy). Dipt. Sviluppo Tecnologie di Punta. Apr 1991. 12p. (In Italian). (RT/INN–90-52). Order Number DE92744023. Source: OSTI; NTIS (US Sales Only).

This paper reports on the design and construction of a 20 cm long optical cell whose temperature can be changed continuously between 50 and 350 degrees K. The cell is cooled by a single stage cryogenerator and thermo-regolated with an electrical feedback system within 5 degrees K or better. The system will be used for measurements of molecular spectroscopy at high resolution by the use of tunable diode lasers.

7486 (LAMP–91/5) **Introduction to optical fiber sensors.** LAMP series report (Laser, Atomic and Molecular Physics). Moukdad, S. International Centre for Theoretical Physics, Trieste (Italy). Jun 1991. 14p. Order Number DE92611161. Source: OSTI; NTIS (US Sales Only); INIS.

Optical fiber sensors have many advantages over other types of sensors, for example: Low weight, immunity from EMI, electrical isolation, chemical passivity, and high sensitivity. In this seminar, a brief explanation of the optical fiber sensors, their use, and their advantages will be given. After, a description of the main optical fiber sensor components will be presented. Principles of some kinds of optical fiber sensors will be presented, and the principle of the fiber-optic rotation sensor and its realization will be discussed in some details, as well as its main applications. (author). 5 refs, 8 figs, 2 tabs.

7487 **Fiber optic detector.** Partin, J.K.; Ward, T.E.; Grey, A.E. To Dept. of Energy. 1990. Filed date 30 Apr 1990. USA Patent patent application 7-516,590. 22p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. Order Number DE92004609. Source: OSTI; NTIS; GPO Dep.

This invention is comprised of a portable fiber optic detector that senses the presence of specific target chemicals by exchanging the target chemical for a fluorescently-tagged antigen that is bound to an antibody which is in turn attached to an optical fiber. Replacing the fluorescently-tagged antigen reduces the fluorescence so that a photon sensing detector records the reduced light level and activates an appropriate alarm or indicator.

7488 **Detection device for hazardous material.** Partin, J.K.; Grey, A.E. To Dept. of Energy. 1990. Filed date 4 Apr 1990. USA Patent patent application 7-504,218. 21p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. Order Number DE92003839. Source: OSTI; NTIS; GPO Dep.

This invention is comprised of a detection device that is activated by the interaction of a hazardous chemical with a coating interactive with said chemical on an optical fiber thereby reducing the amount of light passing through the fiber to a light detector. A combination of optical filters separates the light into a signal beam and a reference beam which after detection, appropriate amplification, and comparison with preset internal signals, activates an alarm means if a predetermined level of contaminant is observed.

7489 Laser metrology for coherent multi-telescope arrays. Shao, M.; Massie, N.A. To Dept. of Energy. 1990. Filed date 16 May 1990. USA Patent patent application 7-524,114. 39p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE92004616. Source: OSTI; NTIS; GPO Dep.

In multi-telescope arrays that comprise multiple telescopes, a beam-combining module, and flat mirrors for directing light beams from the multiple telescopes to the beam combining module, a laser metrology system is used for monitoring various pathlengths along a beam path where deviations are likely. Some pathlengths are defined simply by a pair of retroreflectors or reflectors at both ends. Lengths between pairs of retroreflectors are measured and monitored by laser interferometers. One critical pathlength deviation is related to the displacement of the flat mirror. A reference frame is set up relative to the beam-combining module to form and define the coordinate system within which the positions of the flat mirrors are measured and monitored. In the preferred embodiment, a pair of retroreflectors along the optical axis of the beam-combining module defines a reference frame. A triangle is formed by the reference frame as the base and another retroreflector at the flat mirror as the vertex. The triangle is used to monitor the position of the flat mirror. A beam's pathlength is dynamically corrected in response to the monitored deviations.

7490 High resolution telescope. Massie, N.A.; Oster, Y. To Dept. of Energy. 1990. Filed date 16 May 1990. USA Patent patent application 7-524,118. 39p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE92004617. Source: OSTI; NTIS; GPO Dep.

A large effective-aperture, low-cost optical telescope with diffraction-limited resolution enables ground-based observation of near-earth space objects. The telescope has a non-redundant, thinned-aperture array in a center-mount, single-structure space frame. It employs speckle interferometric imaging to achieve diffraction-limited resolution. The signal-to-noise ratio problem is mitigated by moving the wavelength of operation to the near-IR, and the image is sensed by a Silicon CCD. The steerable, single-structure array presents a constant pupil. The center-mount, radar-like mount enables low-earth orbit space objects to be tracked as well as increases stiffness of the space frame. In the preferred embodiment, the array has elemental telescopes with subaperture of 2.1m in a circle-of-nine configuration. The telescope array has an effective aperture of 12m which provides a diffraction-limited resolution of 0.02 arc seconds. Pathlength matching of the telescope array is maintained by an electro-optical system employing laser metrology. Speckle imaging relaxes pathlength matching tolerance by one order of magnitude as compared to phased arrays. Many features of the telescope contribute to substantial reduction in costs. These include eliminating the conventional protective dome and reducing on-site construction activities. The cost of the telescope scales with the first power of the aperture rather than its third power as in conventional telescopes. 9 figs., 1 tab.

7491 Solid colloidal optical wavelength filter. Alvarez, J.L. To Dept. of Energy. 1990. Filed date 30 May 1990. USA Patent patent application 7-530,673. 16p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. Order Number DE92003980. Source: OSTI; NTIS; GPO Dep.

The present invention relates generally to techniques and methods to filter optical wavelengths for spectroscopy, protection from intense radiation, monochromatizing, and analyzing optical radiation, and more particularly to a solid colloidal rejection filter and a method for constructing a solid colloidal rejection filter. A solid colloidal optical wavelength filter includes a suspension of spherical particles dispersed in a coagulable medium such as a setting plastic. The filter is formed by suspending spherical particles in a coagulable medium; agitating the particles and coagulable medium to produce an emulsion of particles suspended in the coagulable medium; and allowing the coagulable medium and suspended emulsion of particles to cool. 3 figs.

7492 Method for eliminating artifacts in CCD imagers. Turko, B.T.; Yates, G.J. To Dept. of Energy. 1990. Filed date 29 Jun 1990. USA Patent patent application 7-545,732. 25p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098 ;W-7405-ENG-48. Order Number DE92003816. Source: OSTI; NTIS; GPO Dep.

An electronic method for eliminating artifacts in a video camera (10) employing a charge coupled device (CCD) (12) as an image sensor. The method comprises the step of initializing the camera (10) prior to normal read out and includes a first dump cycle period (76) for transferring radiation generated charge into the horizontal register (28) while the decaying image on the phosphor (39) being imaged is being integrated in the photosites, and a second dump cycle period (78), occurring after the phosphor (39) image has decayed, for rapidly dumping unwanted smear charge which has been generated in the vertical registers (32). Image charge is then transferred from the photosites (36) and (38) to the vertical registers (32) and read out in conventional fashion. The inventive method allows the video camera (10) to be used in environments having high ionizing radiation content, and to capture images of events of very short duration and occurring either within or outside the normal visual wavelength spectrum. Resultant images are free from ghost, smear and smear phenomena caused by insufficient opacity of the registers (28) and (32), and are also free from random damage caused by ionization charges which exceed the charge limit capacity of the photosites (36) and (37).

7493 (UCRL–53868-90, pp. 8.1-8.8) **Atmospheric-compensated imaging systems.** Lawrence, T.W.; Goodman, D.M. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

The authors have developed and implemented a new technology for removing the effects of atmospheric turbulence from telescope images. This technology - bispectral speckle interferometry - permits imaging of astronomical objects and satellites to the diffraction limit of the collecting telescope. They have successfully applied this technique to speckle images obtained with a 1.6-m telescope at the Air Force Maui Optical Station on Mt. Haleakala, Maui. They have extracted diffraction-limited features of several satellites, including the Hubble Space Telescope. In addition, they are developing novel, inexpensive wavefront sensor and adaptive optic architectures that can be used for imaging applications, laser beam cleanup, and optical correlography. These technologies should have positive impacts on both astronomical and defense imaging problems.

7494 (UCRL-CR–108117) **Lawrence Livermore National Laboratory Kestrel IV Pointing and Tracking System preliminary design.** Shepherd, O.; Aurilio, G.; Bucknam, R.D. Lawrence Livermore National Lab., CA (United States); Visidyne, Inc., Burlington, MA (United States). 9 Nov 1990. 89p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (VI–1600A). Order Number DE92003985. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This is a technical report documenting the work performed under LLNL Subcontract B116800. This effort consisted of the development of a preliminary design of the KESTREL IV Pointing and Tracking System. This design consists of the payload azimuth bearing assembly, telescope and pointing mirror optics, telescope to payload mounting interface, coarse and fine azimuth and elevation servo systems, and the payload power system. As part of this design three innovative design approaches were developed which could result in a significant payload weight reduction. These were: (1) A pointing system using a pointed telescope which eliminates the requirement for a large gimballed pointing mirror. (2) A light weight pointing mirror which reduces the size of the fine azimuth/elevation gimbal required. (3) The use of primary lithium batteries to significantly reduce the payload battery weight. After the designs submitted in this report are evaluated, and approved by LLNL, the detail drawings can be generated for the azimuth bearing assembly and telescope mass simulator. These assemblies can be fabricated, assembled, and tested at Visidyne, Inc. and then shipped to LLNL where they could be integrated with a test payload. This test payload would then be tested for parachute opening shock and water entry.

7495 (UCRL-CR–108459) **Correlator optical wavefront sensor "COWS," Task 6: Final report.** Lawrence Livermore National Lab., CA (United States); Phillips Lab., Kirtland AFB, NM (United States); Schafer (W.J.) Associates, Inc., Albuquerque, NM (United States). 6 Feb 1991. 43p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE92003964. Source: OSTI; NTIS; GPO Dep.

This report documents the significant upgrades and improvements made to the COWS optical bench during this phase of the program. Software for the experiment was reviewed and documented. Flowcharts showing the program flow are included as well as documentation for programs which were written to calculate and display Zernike polynomials. The system was calibrated and aligned and a series of experiments to determine the optimum settings for the input and output MOSLM polarizers were conducted. In addition, design of a simple aberration generation is included.

7496 (UCRL-JC–107983) **Fast, inexpensive, diffraction limited cylindrical microlenses.** Synder, J.J.; Reichert, P. Lawrence Livermore National Lab., CA (United States). 8 Jul 1991. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9107115–61: Society of Photo-Optical Instrumentation Engineers (SPIE) meeting, San Diego, CA (United States), 21-26 Jul 1991). Order Number DE92003972. Source: OSTI; NTIS; INIS; GPO Dep.

We have developed a technique for fabricating fast, well corrected cylindrical microlenses. With this technique we have made a number of different microlenses with dimensions and focal lengths in the range of few hundred μm, and diffraction limited numerical apertures as high as 0.9. The microlenses are specifically designed for applications where they can increase the radiance or otherwise enhance the optical characteristics of laser diode light. The fabrication method we use is very versatile, and the microlenses produced this way would be very inexpensive in production quantities. 6 refs., 4 figs.

7497 (UCRL-JC–108740) **Speckle imaging of satellites at the Air Force Maui Optical Station.** Lawrence, T.W.; Goodman, D.M.; Johansson, E.M.; Fitch, J.P. Lawrence Livermore National Lab., CA (United States). Oct 1991. 12p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9110296–1: European Southern Observatory (ESO) conference on high resolution imaging by interferometry II, Garching (Germany), 14-18 Oct 1991). Order Number DE92004668. Source: OSTI; NTIS; GPO Dep.

We performed a series of experiments using the Air Force Maui Optical Station's 1.6 m telescope and a bare CCD detector to capture speckle images of various satellites. The speckle images were processed with bispectral techniques for recovering image Fourier phase as well as projection onto convex sets for recovering image Fourier magnitude from the projected autocorrelation. Results of imaging point stars and binaries are shown as a baseline assessment of our techniques. We have reconstructed high quality images of numerous satellites and will show reconstructions of a very familiar satellite: the Hubble Space Telescope. To our knowledge, this is the first demonstration of the use of bare CCDs for speckle imaging of relatively bright objects such as artificial satellites. 13 refs.

4407 Geophysical and Meteorological Instrumentation

Refer also to citation(s) 7585

4408 Miscellaneous Instrumentation

Refer also to citation(s) 6406, 6474, 6835, 7174, 7487, 7633, 7640, 8420

7498 (ANL/CP–74079) **Misalignment sensitivity of an inclined crystal monochromator.** Macrander, A.T.; Lee, W.K. Argonne National Lab., IL (United States). Oct 1991. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-9110146–3: 7. national conference and exhibition on synchrotron radiation instrumentation, Baton Rouge, LA (United States), 28-31 Oct 1991). Order Number DE92004130. Source: OSTI; NTIS; GPO Dep.

The sensitivity of a novel inclined crystal monochromator design to misalignments has been calculated, and compared to data. Rocking curve line narrowing as well as broadening can occur because the asymmetry factor of dynamical diffraction given by $b=s_O \cdot n/s_H \cdot n$ can have an absolute value larger or smaller than unity. Here $s_O \cdot n$ and $s_H \cdot n$ are the direction cosines of the incident and diffracted beams, respectively, and n is the inward surface normal. An inclined double crystal monochromator which is perfectly aligned would have $b = -1$ for both crystals, and only then would the diffraction by symmetric. We have computed b and rocking curve widths for inclination angles of 70.53° and 85.00°, and we compare the 70.53° case to data for silicon {111} reflections using 8 KeV (CuK_{α_1}) radiation. The 70.53° case applies to $(11\bar{1})$ reflection from a (111) oriented crystal. We report that rotations around the reciprocal lattice vector have the expected effect on b.

7499 (CONF-911132–8) **Atomic force microscopy of DNA strands adsorbed on mica: The effect of humidity on apparent width and image contrast.** Thundat, T. (Oak Ridge National Lab., TN (United States)); Warmack, R.J.; Allison, D.P.; Lourenco, A.J.; Ferrell, T.L.; Bottomley, L.A. Oak Ridge National Lab., TN (United States). [1991]. 21p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 38. national symposium of the American Vacuum Society; Seattle, WA (United States); 11-15 Nov 1991. Order Number DE92004404. Source: OSTI; NTIS; GPO Dep.

We investigated the effect of relative humidity on the apparent width and contrast of isolated strands of DNA imaged with atomic force microscopy (AFM). Due to convolution of the tip with DNA, the apparent width of DNA molecules observed with AFM was broader than the known width of DNA. Also, the apparent width of DNA increased with increasing humidity while the contrast of the DNA images decreased with increasing humidity. This phenomena is completely reversible and can be attributed to non-normal forces causing a buckling of AFM cantilever. 20 refs., 4 figs.

7500 (CONF-9109230–8) **Algorithm for a novel fiber-optic weigh-in-motion sensor system.** Tobin, K.W. Jr.; Muhs, J.D. Oak Ridge National Lab., TN (United States). Aug 1991. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From SPIE meeting; Boston, MA (United States); 3-6 Sep 1991. Order Number DE92003538. Source: OSTI; NTIS; GPO Dep.

Over the past decade, the demand from both government and private industry for small, lightweight, vehicle weigh-in-motion (WIM) systems has grown substantially. During the 1980s several techniques for weighing vehicles in motion were developed that include piezoelectric cables, capacitive mats, and hydraulic and bending-plate load cells. These different systems have advantages and disadvantages that trade off between accuracy, physical size and system complexity. The smaller portable systems demonstrate medium to poor accuracy and repeatability while the larger more accurate systems are nonportable. A small, lightweight, and portable WIM system based on a fiber-optic pressure transducer has been developed by Oak Ridge National Laboratory (ORNL) to meet the demands of government and industry. The algorithm for extracting vehicle weight from the time-dependent sensor response is developed and presented in this report, along with data collected by the system for several classes of vehicles. These results show that the ORNL fiber-optic WIM system is a viable alternative to other commercial systems that are presently available. 5 refs., 5 figs.

7501 (DOE/ER/60642–4) **Positron ring system using anger-type detectors: Progress report, February 15, 1991–February 14, 1992.** Karp, J.S. Pennsylvania Univ., Philadelphia, PA (United States). 15 Nov 1991. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER60642. Order Number DE92004052. Source: OSTI; NTIS; INIS; GPO Dep.

The major accomplishments of this year include (1) building and debugging a new set of coincidence electronics for our laboratory setup, (2) performing a series of detector experiments in the dry glove-box aimed at improving the performance of NaI(Tl) position-sensitive detectors, (3) modifying and debugging a Monte Carlo simulation code to test reconstruction algorithms and predict overall performance of a large solid angle PET scanner, (4) significant progress in the 3-D reprojection reconstruction algorithm and comparison to the 2-D single-slice algorithm and a 3-D multi-slice rebinning algorithm, (5) performance comparisons of the two PENN-PET scanners, which lead to a design for a large solid angle scanner with a 25-cm axial extent.

7502 (JINR-R--10-90-335) **A set of blocks for time measurements developed in the Laboratory of Nuclear Problems, JINR.** Grebenyuk, V.M.; Selikov, A.V. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems. 1990. 12p. (In Russian). Order Number DE92611157. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to the Organizing Committee of the 14-th Intern. Symp. on Nucl. Electronics, September 1990, Warsawa.

The paper briefly describes the block for time measurements made to the CAMAC standard. They are: two-channel converter KA304, multistop converters KA326, KA330, KA393, quartz generator KB311, generator of pulses randomly distributed in time KA316 and 'Start-Stop' generator KA333. The above devices are manufactured by the Experimental Workshop of JINR and are effectively used at the experimental facilities of LNP and at the work stations of electronic equipment designers. 9 refs.; 8 figs.

7503 (JINR-R--10-90-398) **Microprocessor controller in CAMAC standard for temperature regulation and stabilization.** Nguen N'i D'en; Rodionov, K.G. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics. 1990. 11p. (In Russian). Order Number DE92611158. Source: OSTI; NTIS (US Sales Only); INIS.

The microprocessor controller in CAMAC standard for temperature regulation and stabilization of an external object (electric furnance, thermostat) is described. The controller has two control regimes - parallel and serial regimes and has been controlled by personal computer PC/XT/AT. The apparatus that has been created and software supply allow linearly to raise or to lower temperature of samples to indicated value with different rates, to stabilize temperature on a level is set, to record a graph of current temperature both at time of heating or cooling down and at time of stabilization with different frequency that is set by the program. 3 refs.; 3 figs.

7504 (JINR-R--13-90-400) **Automatic proton resonance magnetometer up to 6 T.** Ivashkevich, S.A.; Lagish, J. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems. 1990. 6p. (In Russian). Order Number DE92611159. Source: OSTI; NTIS (US Sales Only); INIS.

A nuclear magnetic resonance magnetometer with automatic signal search and field tracking is described. The magnetometer serves for measurements of the plane gap magnet fields, as well as the solenoid fields. The range of the measured fields is 0.06-6 T. The proton resonance is used throughout the whole field range. The permissible inhomogeneity of the measured field is 0.5% cm^{-1}, the measurement error being 0.01%. The probe is connected with the rest part of the magnetometer and frequency meter by cables up to several tens of meters long, which allows to distant fiel measurements. 4 refs.; 1 fig.; 1 tab.

7505 (LBL--30456) **Varied line-space gratings and applications.** McKinney, W.R. Lawrence Berkeley Lab., CA (United States). 15 Jul 1991. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-910730--25: 4. international conference on synchrotron radiation instrumentation, Chester (United Kingdom), 15-19 Jul 1991). Order Number DE92003902. Source: OSTI; NTIS; INIS; GPO Dep.

This paper presents a straightforward analytical and numerical method for the design of a specific type of varied line-space grating system. The mathematical development will assume plane or nearly-plane spherical gratings which are illuminated by convergent light, which covers many interesting cases for synchrotron radiation. The gratings discussed will have straight grooves whose spacing varies across the principal plane of the grating. Focal relationships and formulae for the optical grating-pole-to-exist-slit distance and grating radius previously presented by other authors will be derived with a symbolic algebra system. It is intended to provide the optical designer with the tools necessary to design such a system properly. Finally, some possible advantages and disadvantages for application to synchrotron to synchrotron radiation beamlines will be discussed.

7506 (LBL--31121) **Atomic force microscopy images of T4 bacteriophages on silicon substrates.** Kolbe, W.F.; Ogletree, D.F.; Salmeron, M.B. Lawrence Berkeley Lab., CA (United States). Aug 1991. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-9108153--2: 1991 scanning tunneling microscopy, Interlaken (Switzerland), 12-16 Aug 1991). Order Number DE92004159. Source: OSTI; NTIS; GPO Dep.

A new atomic force microscope incorporating microfabricated cantilevers and employing laser beam deflection for force detection has been constructed and is being applied to studied of biological material. In this study, T4 bacteriophage virus particles were deposited from solution onto electronic grade flat silicon wafers and imaged in air with the microscope. Microliter droplets of the solution were deposited and either allowed to dry or removed with blotting paper. The images show both isolated viruses and aggregates of various sizes. The external structure as well as strands believed to be DNA streaming out of the virus could be observed. The construction of the microscope and its performance are also described. 19 refs., 4 figs.

7507 (ORNL/TM--12005) **Atom probe field ion microscopy and related topics: A bibliography 1990.** Russell, K.F.; Miller, M.K. Oak Ridge National Lab., TN (United States). Dec 1991. 43p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE92005518. Source: OSTI; NTIS; GPO Dep.

This bibliography includes references related to the following topics: atom probe field ion microscopy (APFIM), field ion microscopy (FIM), field emission (FE), ion sources, and field desorption mass microscopy (FDMM). Technique-orientated studies and applications are included. The bibliography covers the period 1990. The references contained in this document were compiled from a variety of sources including computer searches and personal lists of publications. To reduce the length of this document, the references have been reduced to the minimum necessary to locate the articles. The references, listed alphabetically by authors, are subdivided into the categories listed in paragraph one above. An Addendum of references missed in previous bibliographies is included.

7508 **Fiber optic geophysical sensors.** Homuth, E.F. To Dept. of Energy. 1990. Filed date 10 Apr 1990. USA Patent patent application 7-506,741. 16p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE92003875. Source: OSTI; NTIS; GPO Dep.

This invention is comprised of a fiber optic geophysical sensor in which laser light is passed through a sensor interferometer in contact with a geophysical event, and a reference interferometer not in contact with the geophysical event but in the same general environment as the sensor interferometer. In one embodiment, a single tunable laser provides the laser light. In another embodiment, separate tunable lasers are used for the sensor and reference interferometers. The invention can find such uses as monitoring for earthquakes, and the weighing of objects. 2 figs.

7509 **Design and implementation of a dc-based magnetic field controller.** Kotter, D.K.; Rankin, R.A.; Morgan, J.P. To Dept. of Energy. 1990. Filed date 14 May 1990. USA Patent patent application 7-522,877. 12p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-84ID12435. Order Number DE92004615. Source: OSTI; NTIS; GPO Dep.

This invention is comprised of a magnetic field controller for laboratory devices and in particular to dc operated magnetic field controllers for mass spectrometers, comprising a dc power supply in combination with improvements to a hall probe subsystem, display subsystem, preamplifier, field control subsystem, and an output stage. 1 fig.

7510 **Convergent x-ray monochromator for molecular microprobe analysis.** Gamba, O.O.M. To Dept. of Energy. 1990. Filed date 29 May 1990. USA Patent patent application 7-529,403.

19p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC11-89PN38014. Order Number DE92004619. Source: OSTI; NTIS; GPO Dep.

An improved apparatus and method are provided for electron spectroscopy for chemical analysis which permits analysis of micron sized regions of a heterogeneous sample surface. The apparatus includes a source of multidirectional X-ray radiation. A hollow cylindrical body receives the multidirectional X-ray radiation. The hollow cylindrical body includes a plurality of beam directing Johannsen-type diffracting crystals elements arrayed symmetrically and circumferentially around an axis of symmetry extending from the source of X-ray radiation to a surface of the sample. The array of Johannsen-type diffracting crystals transforms the multidirectional X-ray radiation into a hollow cone of monochromatic X-ray radiation that converges on a micron sized region on the sample surface. A screen opaque to X-rays is located along the axis of symmetry between the source of X-ray radiation and the sample. The screen prevents X-rays from the source from reaching the sample without being directed and diffracted by the beam directing and diffracting elements. An electron detector located along the axis of symmetry detects electrons emitted from the micron sized region of the sample surface. The electron detector is located between the X-ray screen and the sample surface. 4 figs.

7511 Method and apparatus for measuring surface contour on parts with elevated temperatures. Horvath, M.S.; Nance, R.A.; Cohen, G.H.; Fodor, G.E. To Dept. of Energy. 1990. Filed date 31 May 1990. USA Patent patent application 7-531,356. 18p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC11-76PN00014. Order Number DE92003662. Source: OSTI; NTIS; GPO Dep.

The invention is directed to a method and apparatus for measuring the surface contour of a test piece, such as the bow of a radioactive fuel rod, which is completely immersed in water. The invention utilizes ultrasonic technology and is capable of measuring surface contours of test pieces which are at a higher temperature than the surrounding water. The presence of a test piece at a higher temperature adversely affects the distance measurements by causing thermal variations in the water near the surface of the test piece. The contour measurements depend upon a constant temperature of the water in the path of the ultrasonic wave to provide a constant acoustical velocity (the measurement is made by the time of flight measurement for an ultrasonic wave). Therefore, any variations of water temperature near the surface will introduce errors degrading the measurement. The present invention overcomes these problems by assuring that the supply of water through which the ultrasonic waves travel is at a predetermined and constant temperature. 3 figs.

7512 Method and apparatus for acoustic plate mode liquid-solid phase transition detection. Blair, D.S.; Frye, G.C.; Hughes, R.C.; Martin, S.J.; Ricco, A.J. To Dept. of Energy. 1990. Filed date 31 May 1990. USA Patent patent application 7-531,492. 19p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE92003778. Source: OSTI; NTIS; GPO Dep.

A method and apparatus for sensing a liquid-solid phase transition event is provided which comprises an acoustic plate mode detecting element placed in contact with a liquid or solid material which generates a high-frequency acoustic wave that is attenuated to an extent based on the physical state of the material in contact with the detecting element. The attenuation caused by the material in contact with the acoustic plate mode detecting element is used to determine the physical state of the material being detected. The method and device are particularly suited for detecting conditions such as the icing and deicing of wings of an aircraft. In another aspect of the present invention, a method is provided wherein the adhesion of a solid material to the detecting element can be measured using the apparatus of the invention. 3 figs.

7513 Fiber-optic voltage sensor. Wood, C.B. To Dept. of Energy. 1990. Filed date 12 Jul 1990. USA Patent patent application 7-551,834. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP03533. Order Number DE92003823. Source: OSTI; NTIS; GPO Dep.

A fiber optic voltage sensor is described which includes a source of light, a reference fiber for receiving a known percentage of the light and an electrostrictive element having terminals across which is applied, a voltage to be measured. The electrostrictive element is responsive to the applied voltage to assume an altered physical state. A measuring fiber also receives a known percentage of light from the light source and is secured about the electrostrictive element. The measuring fiber is provided with a cladding and exhibits an evanescent wave in the cladding. The measuring fiber has a known length which is altered when the electrostrictive element assumes its altered physical state. A differential sensor is provided which senses the intensity of light in both the reference fiber and the measuring fiber and provides an output indicative of the difference between the intensities.

7514 (SAND-91-2303C) **Development of a high-accuracy motion compensation, pointing, and stabilization system for a synthetic aperture radar.** Fellerhoff, J.R.; Kohler, S.M. Sandia National Labs., Albuquerque, NM (United States). [1991]. 12p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-920351-1: 1992 IEEE position, location and navigation symposium, Monterey, CA (United States), 24-27 Mar 1992). Order Number DE92002361. Source: OSTI; NTIS (US Sales Only); GPO Dep.

An advanced synthetic Aperture Radar Motion Compensation System has been developed by Sandia National Labs (SNL). The system includes a miniaturized high accuracy ring laser gyro inertial measurement unit, a three axis gimbal pointing and stabilization assembly, a differential Global Positioning System (GPS) navigation aiding system, and a pilot guidance system. The system provides unique improvements over previous SNL motion compensation systems and is capable of antenna stabilization to less than 0.01 degrees RMS, absolute antenna velocity measurements to less than 0.1 m/s RMS, and absolute position measurement to less than 5.0 meters RMS. These accuracies have been demonstrated in recent flight testing aboard a DHC-6-300 "Twin Otter" aircraft. 11 figs.

7515 (SAND-91-2376C) **Combined VISAR and flash x-ray testing techniques.** Sanchez, D.H. (Sandia National Labs., Albuquerque, NM (United States)); Lanoue, J.C.; Lare, G.A. Sandia National Labs., Albuquerque, NM (United States). [1991]. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9110282-2-Vugraphs: 16. annual joint firing set conference, Livermore, CA (United States), 15-17 Oct 1991). Order Number DE92004732. Source: OSTI; NTIS (US Sales Only); GPO Dep.

We have developed an experimental facility that provides simultaneous imaging of flyer plates with measurement of flyer velocity. This system allows us to test both explosive and electrically-driven flyers over a temperature range of −54° to +74°C. Our Velocity Interferometer System for Any Reflector (VISAR) is capable of measuring flyer velocities from 0.5 to 6 nm/μs. The flash x-ray system allows recording images of flyers with a minimum thickness of 0.05 mm and a minimum diameter of 0.002 inches.

7516 (UCRL-53868-90, pp. 7.9-7.13) **Fieldable sensor systems for environmental contaminants.** McKinley, B.J.; McCue, H.K.; Milanovich, F.P.; Angel, M.S. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

The authors objective is to develop diagnostic instruments to measure the levels of a variety of physical and chemical contaminants in the field. There are two phases to this project: To assess and prioritize the needs for new environmental measurement systems, and then to develop complete fieldable instruments. They have completed the first phase, and find a widespread need for chemical sensors to measure contaminant levels in liquids and gases, and on solid surfaces. They have selected Raman spectroscopy as the first system for development due to its wide applicability.

45 MILITARY TECHNOLOGY, WEAPONRY, AND NATIONAL DEFENSE

Refer also to citation(s) 6466, 7514, 8173

7517 (ORNL–6684) **Navy Mobility Fuels Forecasting System report: Navy fuel production in the year 2000.** Hadder, G.R.; Davis, R.M. Oak Ridge National Lab., TN (United States). Sep 1991. 41p. Sponsored by U.S. Department of Defense. DOE Contract AC05-84OR21400. Order Number DE92004599. Source: OSTI; NTIS; GPO Dep.

The Refinery Yield Model of the Navy Mobility Fuels Forecasting System has been used to study the feasibility and quality of Navy JP-5 jet fuel and F-76 marine diesel fuel for two scenarios in the year 2000. Both scenarios account for environmental regulations for fuels produced in the US and assume that Eastern Europe, the USSR, and the People's Republic of China have free market economies. One scenario is based on business-as-usual market conditions for the year 2000. The second scenario is similar to first except that USSR crude oil production is 24 percent lower. During lower oil production in the USSR., there are no adverse effects on Navy fuel availability, but JP-5 is generally a poorer quality fuel relative to business-as-usual in the year 2000. In comparison with 1990, there are two potential problems areas for future Navy fuel quality. The first problem is increased aromaticity of domestically produced Navy fuels. Higher percentages of aromatics could have adverse effects on storage, handling, and combustion characteristics of both JP-5 and F-76. The second, and related, problem is that highly aromatic light cycle oils are blended into F-76 at percentages which promote fuel instability. It is recommended that the Navy continue to monitor the projected trend toward increased aromaticity in JP-5 and F-76 and high percentages of light cycle oils in F-76. These potential problems should be important considerations in research and development for future Navy engines.

7518 (ORNL/TM–11933) **Successful Army National Guard units: A guard perspective.** Wolfe, A.K. (Oak Ridge National Lab., TN (United States)); Saulsbury, J.W.; Schexanayder, S.M. Oak Ridge National Lab., TN (United States). Oct 1991. 59p. Sponsored by U.S. Department of Defense. DOE Contract AC05-84OR21400. Order Number DE92004593. Source: OSTI; NTIS; GPO Dep.

For National Guard Bureau, Falls Church, VA.

This project sought to identify factors contributing to a healthy Army National Guard (ARNG) unit. Its results were intended to contribute to a computerized forecasting model under development at Oak Ridge National Laboratory. The model, the ARNG Regional Recruiting Potential Model (RRPM), forecasts locations of successful new or modified Guard units. The study was expected to enhance the understanding of what constituents a healthy Guard unit. A Delphi approach was used to define criteria for healthy Guard units and to elicit rankings of those criteria. Two sets of telephone interviews were conducted with a sample of 102 individuals-two battalion-level administrative officers, or their equivalents, in each state in Washington, DC. During these telephone calls, the phrase "unit supportability" was used to express the notion of a healthy unit. The first set of interviews obtained background information and respondents' ideas of the criteria that lead to unit supportability and to a lack of supportability. The data were analyzed to develop a list of ten criteria for unit supportability. In the second interview, the same respondents were asked to rank those criteria in order of importance.

7519 (SAND–91-0955) **Radar-cross-section measurement errors caused by test object interaction with low-dielectric-constant supports.** Brock, B.C.; Patitz, W.E.; Sorensen, K.W.; Zittel, D.H. Sandia National Labs., Albuquerque, NM (United States). Aug 1991. 27p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE92004758. Source: OSTI; NTIS; GPO Dep.

In the search for an ideal test-object support for simulated free-space radar-cross-section (RCS) measurements, low-density polystyrene foam has achieved considerable popularity. However, significant error can be introduced into a measurement by the use of an inappropriately designed support. Although low back-scatter radar cross section (RCS) can be obtained with this material, interactions can occur between the test object and the mount which will cause measurement errors in excess of several dB. We present results of measurements performed on a simple test object supported on a low-density foam column which demonstrate this effect. As we discuss, this error can be incorrectly interpreted to be caused by poor mechanical alignment of the test object with the radar-range coordinate system. We discuss trade-offs associated with the choice between electrical and mechanical boresighting of the test object. Finally, we show that the error can be explained by differential propagation effects. In addition, this simple theory provides the insight necessary to devise appropriate measures to minimize the errors caused by the presence of the support. 4 refs., 6 figs.

7520 (UCRL–53868-90, pp. 8.12-8.16). **Radar ocean imaging.** Fitch, J.P.; Brase, J.M.; Yorkey, T.J. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

The field of non-acoustic antisubmarine warfare (ASW), and in particular, the use of radar ocean iamging for submarine detection has received renewed attention over the past several years for a variety of reasons. These reasons include: (1) the strategic importance that any breakthrough in detection capability would signify, (2) the decreased performance of acoustic detection techniques due to recent improvements in submarine quieting, and (3) indications of major Soviet research and development activity in the area of radar ocean imaging. The authors are investigating the use of radar imaging to study ocean surface effects resulting from ship-generated internal waves. Their research offers potential application to non-acoustic antisubmarine warfare.

7521 (UCRL–53868-90, pp. 8.9-8.11) **Automatic target recognition.** Clark, G.A.; Hernandez, J.E.; Lawver, B.S.; Wieting, M.G. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

The authors have developed a computer vision laboratory to use for engineering research and development on a prototype automatic-target-recognition (ATR) system. Their current ATR system correctly identifies objects in simulated images. The overall system, using Gabor transforms and a neural network, has been shown to be robust with respect to variations in orientation, scale, and translation of the objects.

4501 Chemical Explosions and Explosives

Refer also to citation(s) 7041, 7159, 7407, 7515, 7527

7522 (LA–12173-MS) **Vacuum thermal stability of explosives monitored electronically.** Baytos, J.F. Los Alamos National Lab., NM (United States). Nov 1991. 20p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE92003735. Source: OSTI; NTIS; GPO Dep.

Two innovations make the vacuum thermal stability (VTS) of explosives amenable to electronic monitoring. The first innovation is that the manometer tube is incorporated as a capacitance transducer into a circuit that generates a voltage proportional to the height of the manometer column. The second innovation is an air back-pressure system by which an air-pressure reduction valve is used to adjust the height of the mercury column so that voltage can be calibrated as a function of the height of the mercury column with the manometer in place. Addition of a power supply/demodulator unit, a data acquisition/control unit, and a dedicated computer complete the monitoring system. A complete description of Los Alamos National Group M-1's modular VTS system is reported, including the heating bath, temperature controller, pressure system, and electronics for data acquisition. Errors of the system are discussed, and typical results for some explosives are given. The calibration, operating, and reporting procedures are given in the Appendices.

7523 (LA–12188-MS) **High explosive material testing laboratory scale model test.** Bolton, B.L.; Browning, R.V.; Berkbigler, L.W. Los Alamos National Lab., NM (United States). Dec 1991. 31p. Sponsored by U.S. DOE Defense Programs. DOE Contract

W-7405-ENG-36. Order Number DE92005351. Source: OSTI; NTIS; GPO Dep.

An experimental study of the personnel protective capability of a proposed high explosive material test laboratory using a one-eighth-scale model is summarized. Various configurations of the scale model were tested against internal blast loading over a range of scaled explosive charged weights. Pressures and resulting impulses were measured at pertinent locations on the model. The experimental results are compared with standard blast loading calculation methods. This study provides data for developing guidelines to protect personnel in typical high explosive test facilities.

7524 **Laser-driven flyer plate.** Paisley, D.L. To Dept. of Energy. 1990. Filed date 2 Apr 1990. USA Patent patent application 7-502,956. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE92003832. Source: OSTI; NTIS (US Sales Only); GPO Dep.

This invention is comprised of apparatus for producing high velocity flyer plates involving placing a layer of dielectric material between a first metal foil and a second metal foil. With laser irradiation through an optical substrate, the first metal foil forms a plasma in the area of the irradiation, between the substrate and the solid portion of the first metal foil. When the pressure between the substrate and the foil reaches the stress limit of the dielectric, the dielectric will break away and launch the flyer plate out of the second metal foil. The mass of the flyer plate is controlled, as no portion of the flyer plate is transformed into a plasma. 2 figs.

7525 (SAND–91-1882) **Reliability and safety analyses of the Small Projected Line Charge.** Pierce, K.G. Sandia National Labs., Albuquerque, NM (United States). Aug 1991. 31p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE92004782. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The Small Projected Line Charge (SAPLIC) is being developed as a tool for crossing anti-personnel mine fields. This report documents the reliability and safety analyses of the system. The equation relating system reliability to the reliability of the individual components is given, and testing to satisfy the reliability specification is discussed. Fault-tree analyses for premature ignition of the deployment rocket and the line charge were performed. The equations describing the probabilities of premature are given and discussed.

7526 (SAND–91-2486C) **Explosive vapor emission.** Kenna, B.T.; Conrad, F.J.; Hannum, D.W. Sandia National Labs., Albuquerque, NM (United States). [1991]. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9111129–1: FAA explosives detection symposium, Atlantic City, NJ (United States), 13-15 Nov 1991). Order Number DE92002932. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Emission rates of explosive vapors from explosive samples dictate whether various techniques can be used to provide a constant vapor source for instrument evaluation. Indeed, emission rates determine whether a particular detection system is applicable directly for explosive vapor detection or if an initial "helping" step, such as preconcentration, is required. This work is a theoretical study of emission rate for TNT and RDX. Two vapor source techniques are evaluated, viz. a wire mesh screen coated with explosive material in a "hair dryer" air flow and a packed column of various lengths which has air flow through it. 3 refs., 5 figs.

4502 Nuclear Explosions and Explosives

Refer also to citation(s) 6761, 7448

7527 (ANL/CP–73505) **APSTNG: Radiation interrogation for verification of chemical and nuclear weapons.** Rhodes, E. (Argonne National Lab., IL (United States)); Dickerman, C.E.; DeVolpi, A.; Peters, C.W. Argonne National Lab., IL (United States). [1991]. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-31109-ENG-38. (CONF-911106–35: IEEE nuclear science symposium, Santa Fe, NM (United States), 5-9 Nov 1991). Order Number DE92003998. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A recently developed neutron diagnostic probe system has the potential to satisfy a significant number of van-mobile and fixed-portal requirements for nondestructive verification of sealed munitions. The probe is based on a unique associated-particle sealed-tube neutron generator (APSTNG) that interrogates a TLI with a low-intensity beam of 14-MeV neutrons generated from the deuterium-tritium reaction and that detects the alpha-particle associated with each neutron. Gamma-ray spectra of resulting neutron inelastic scattering and fission reactions identify nuclides associated with all major chemicals in chemical warfare agents, explosives, and drugs, as well as many pollutants and fissile and fertile special nuclear material. Flight times determined from detection times of the gamma-rays and alpha-particles yield a separate tomographic image of each nuclide. The APSTNG also forms the basis for a compact fast-neutron transmission imaging system that can be used along with or instead of the emission imaging system. The small and relatively inexpensive APSTNG exhibits high reliability and can be quickly replaced. Proof-of-concept experiments have been performed under laboratory conditions for simulated nuclear, high-explosive, and chemical warfare munitions.

7528 (CONF-8909163–16) **The Delamar fracture zone: Recognition of unmapped zones of weakness on Pahute Mesa, Nevada Test Site.** Covington, H.R. Geological Survey, Mercury, NV (United States). [1989]. 12p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AI08-86NV10583. From 5. symposium on containment of underground nuclear explosions; Santa Barbara, CA (United States); 19-21 Sep 1989. Order Number DE92004280. Source: OSTI; NTIS; GPO Dep.

The Delamar underground nuclear test, conducted at Pahute Mesa, Nevada Test Site, formed extensive fracture zones. The orientation, extent (more than 500 m north and south of surface ground zero), and linear distribution of the fractures suggest the presence of two preexisting zones of weakness. Because these zones had not been identified prior to the test, studies were initiated to determine that nature of these zones and to define methods to identify similar zones in the future. The methods selected to characterize the fracture zones were mapping surface effects on low-altitude aerial photographs, (2) trenching, (3) exploratory drilling, and (4) surface magnetic surveys. Preliminary results of these investigations show that the two fracture zones occurred along preexisting zones of weakness. The studies also determined that previously unrecognized zones of weakness may be identified using surface mapping techniques. The primary surface features that can be used in the recognition of such zones are (1) a linear feature or an albedo change across a linear future, on aerial photographs, (2) a linear break between areas of very little and abundant caliche clasts in the surface soil, (3) a linear disruption of rock varnish, and (4) a liner distribution of chalcedony clasts in the surface soil. The recognition of these zones of weakness during pre-drill field investigation at future sites will allow an early assessment of the possible impact of these structures on containment, and provide data for possible relocation of the site.

7529 (LA-UR–91-3749) **Timing system for firing widely spaced test nuclear detonations.** Partridge, R.E. Los Alamos National Lab., NM (United States). [1991]. 13p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-911269–1: Precision time and time interval (PTTI) meeting, Pasadena, CA (United States), 3-5 Dec 1991). Order Number DE92003793. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The national nuclear weapons design laboratories (Los Alamos National Laboratory and Lawrence Livermore National Laboratory) test fire nuclear devices at the Nevada Test Site (NTS), which is spread over an area of over 1200 square miles (a bit larger than the state of Rhode Island). On each test there are hundreds of high time resolution recordings made of nuclear output waveforms and other phenomena. In order to synchronize these recordings with each other, with the nuclear device, and with offsite recordings, there is a requirement that the permanent command center and the outlying temporary firing sites be time tied to each other and to UTC to permit firing the shot at a predetermined time with an accuracy of about a microsecond. The system is so designed that this can be reduced to about 100 nanoseconds if it should prove necessary in the future. New firing sites are created about every month. A year or so lead time is needed to drill and prepare each ground zero emplacement hole and its associated trailer park in the forward area. A few weeks before the nuclear device is brought in, the recording stations and trailers are emplaced in the trailer park and interconnected, and dry runs begin. By this time the trailer park timing stating has been linked to the control room at the command center control point by fiber optics or microwaves. The timing station and the control room are synchronized by travelling clocks, by the communication links, and by GPS receivers. The control room can be linked simultaneously with up to four forward area sites in various stages of preparation.

7530 (RFP–4349) **Substituting water for chlorofluorocarbon liquid in density measuring baths for nuclear weapon components on non-fissile alloys.** Beitscher, S.; Palachek, A.D. EG and G Rocky Flats, Inc., Golden, CO (United States). Rocky Flats Plant. 23 Sep 1991. 18p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC34-90DP62349. Order Number DE92005227. Source: OSTI; NTIS; GPO Dep.

This project was part of a Rocky Flats Plant and Department of Energy weapons complex effort to reduce release of hazardous materials to the atmosphere. Experiments were performed to determine whether deionized water could be substituted for trichlorotrifluoroethane (CFC 113) in the bath of a density measuring system. In the first experiment, 14 parts of seven types were tested: They included shells of beryllium, vanadium, titanium, stainless steel, uranium, a uranium alloy, and casting feed strips of a uranium alloy. Each part was measured for density five times in each medium. The entire experiment was repeated – the only change being addition of a wetting agent to the water. Two additional experiments were confided to the uranium alloy casting feed strips. As a result of this study, it is recommended that CFC be discontinued as a bath medium for the part types studied in this investigation and that deionized water be substituted.

7531 (SAND–90-2711) **Fiberline stronglink: Design and implementation.** Kuehn, S.F.; Sweatt, W.C. Sandia National Labs., Albuquerque, NM (United States). Dec 1991. 31p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE92004115. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The CAE, Switching, and Optic Devices Division (2542), with the assistance of the Photometrics and Optical Development Division (2756), is providing an optical stronglink design for the Direct Optical Initiation program. In this report, the design criteria and test results are described for the use of a corner cube (retroreflector) and the MC3831 D-module stronglink mechanism.

7532 (SAND–90-8248) **Survey of metal finishing capabilities in the Nuclear Weapons Complex.** Johnson, H.R.; Stoltz, R.E. Sandia Labs., Livermore, CA (United States). Dec 1990. 60p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DR00789. Order Number DE92004679. Source: OSTI; NTIS; GPO Dep.

This report presents the results of a survey of the metal finishing capabilities of the following design and production agencies in the Nuclear Weapon Complex: Allied Signal Aerospace Co. (AS), General Electric Neutron Device Division (GEND), Los Alamos National Laboratory (LANL), Lawrence Livermore National Laboratory (LLNL), EG&G Mound Applied Technology (MD), EG&G Rocky Flats Plant (RF), Sandia National Laboratories, Albuquerque (SNL, A), Sandia National Laboratories, Livermore (SNL, L) and Martin Marietta Energy Systems, Inc. (Y-12). It defines the current status of electroplating and its allied processes at each of these agencies, the methods and procedures for handling waste, and the major environmental, safety, and health issues confronting metal finishing personnel.

7533 (SAND–91-2328) **Development report on the DT1115 development tester for the MC4073 SRAM II Programmer.** Brewer, T.H.; Clark, J.D.; Fajardo, P.L.; Furry, C.M.; Jensen, D.L.; Marcon, J. Jr. Sandia National Labs., Albuquerque, NM (United States). Dec 1991. 26p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE92004853. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Supersedes Development Report dated May 21, 1990.

This report describes the DT1115 test system that was designed by Sandia's Digital Subsystems and Test Equipment Division 2313 to support the development of the MC4073 SRAM 2 Programmer. The MC4073 was designed by Sandia's Digital Subsystems 3 Division 2314 and is produced by Allied Signal Kansas City Division (KCD). The DT1115 is used at KCD to test Group 2 and Group 2A MC4073s per the requirements of AC411399-300 INSPECTION REQUIREMENTS, MC4073. The SE3158 test system, designed by Division 2314, is used at Sandia to test the MC4073.

4503 Nuclear Explosion Detection

7534 (UCRL-ID–108241) **The LLNL configurable seismic monitoring system: Final report.** Nakanishi, K.K.; Zucca, J.J.; Bowman, B.C.; Ewert, D.W.; Harben, P.E.; Jarpe, S.P.; Johnston, C.A.; Rock, D.W. Lawrence Livermore National Lab., CA (United States). 23 Sep 1991. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE92004634. Source: OSTI; NTIS; GPO Dep.

Lawrence Livermore National Laboratory (LLNL) developed and tested a portable, high-quality seismic recording system for monitoring underground nuclear explosions. The configurable seismic monitoring system (CSMS) was designed to satisfy the designated seismic station (DSS) requirements for instrumentation to be deployed in a vault as set forth in the protocol of the Threshold Test Ban Treaty (TTBT). As a proof-of-concept test under treaty monitoring conditions, two configurations of this system were built, and each was deployed at a different seismic station to record the Nevada Test Site (NTS) event Bexar. Both configurations successfully recorded this event, demonstrating the flexibility and the operation of the basis design. 3 refs., 8 figs.

4505 Strategic Defense Initiative

7535 (DOE/SF/17124–T1) **A superior optical baffle material: Final report.** Spire Corp., Bedford, MA (United States). Nov 1988. 53p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC03-87SF17124. (FR–10107). Order Number DE92004335. Source: OSTI; NTIS (US Sales Only); GPO Dep.

The work reported on in this document addresses problems affecting the presently available optical baffle materials for space-based telescopes or strategic optical systems. During the course of this one year effort substantial progress has been achieved in the creation of a new form of durable radiation-hardened metallic light-absorbing baffle material. It is believed that there is great potential for solving many of the problems encountered in the design and fabrication of protective baffles through extension of the ideas and procedures developed in this program. The new baffle material developed also has potential for being used as a laser hard, high emissivity surface for heat radiatus in space.

7536 (LA–11810-MS) **National security uses of space: Status, prospects, and issues.** Browne, J.C.; Garrity, P.J.; Canavan, G.H. Los Alamos National Lab., NM (United States). Jan 1992. 15p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE92005354. Source: OSTI; NTIS (US Sales Only); GPO Dep.

National security uses of space have grown rapidly in the last two decades because only space platforms can perform certain vital missions. Currently, space-based systems are used for information communication, and early warning. The pressure for more, and more capable, space systems should grow as fast over the next two decades as it has in the last two in support of strategic deterrence, conventional military operations, and strategic defenses.

7537 (LA–11855-MS) **Suppression of space-based interceptors by neutral particle beams.** Canavan, G.H. Los Alamos National Lab., NM (United States). Nov 1991. 15p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-7405-ENG-36. Order Number DE92004339. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Neutral particle beams (NPBs) popped up before missile launch could irradiate space-based interceptors (SBIs), suppressing those that could effectively attack the missiles. NPB effectiveness could be quite high against unshielded, undecoyed SBIs. The results sensitive to launch radius, beam brightness, and SBI hardness. Even low-brightness NPBs would be effective in suppressing the threats over compact launch areas. 20 refs.

7538 (LA–11880-MS) **Approximate average deployments versus defense parameters.** Canavan, G.H. Los Alamos National Lab., NM (United States). Dec 1991. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE92004751. Source: OSTI; NTIS; GPO Dep.

Calculations of the number of reentry vehicles (RVs) killed as a function of missile and defense parameters can be well approximated by analytic expressions that are valid for all numbers of missiles and interceptors. The approximation uniformly underestimates the effectiveness of boost-phase defenses: the discrepancies in kill rates are about 10%. If if is used to size the boost phase of two-layer defenses, the uncertainties would at worst double the demands on the midcourse layer, which is generally a minor part of the total. 4 refs., 3 figs.

7539 (LA–12064-MS) **Role of terminal defenses in strategic defense.** Canavan, G.H. Los Alamos National Lab., NM (United States). Dec 1991. 14p. Sponsored by U.S. DOE Office of Administration and Human Resource Management; U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE92004340. Source: OSTI; NTIS; GPO Dep.

Terminal interceptors can use the atmosphere for discrimination. They also have disadvantages in development, cost, saturation, and susceptibility to preferential attacks. Terminal could be preferred for higher midcourse costs or decoys. Their main limitation is battlespace. It is possible to integrate boost- and terminal-phase defenses by reducing the number of reentry vehicles penetrating the boost phase to the roughly one per target terminal defenses could handle. Terminal defenses could offset boost-phase defenses' lack of preferentiality and midcourse defenses; sensitivity to decoys. 15 refs.

4506 Chemical and Biological

Refer also to citation(s) 7407, 7527

7540 (CONF-9111126–2) **From nuclides to nerve gas: The development of the Chemical Stockpile Emergency Preparedness Exercise Program.** Gant, K.S.; Adler, M.V. Oak Ridge National Lab., TN (United States). [1991]. 13p. Sponsored by U.S. Federal Emergency Management Agency. DOE Contract AC05-84OR21400. From 15. annual TRADE (training resources and data exchange) conference; St. Petersburg, FL (United States); 18-20 Nov 1991. Order Number DE92003511. Source: OSTI; NTIS; INIS; GPO Dep.

The Army and the Federal Emergency Management Agency established the Chemical Stockpile Emergency Preparedness Program (CSEPP), to improve emergency preparedness around each location storing the nation's aging stockpile of unitary chemical weapons. The CSEPP requires that a series of exercises be conducted at each location on a regular schedule. The CSEPP exercise program drew upon the existing Army and civilian exercises. Merging the exercise traditions of both the communities and installations into a joint exercise program acceptable to both sides and the particular nature of the hazard required a number of adjustments in the usual approaches. 14 refs., 1 fig.

54 ENVIRONMENTAL SCIENCES

Refer also to citation(s) 6485, 6593

7541 (UCRL-JC–108358) **Environmental database at a superfund site.** Cederwall, P.L. Lawrence Livermore National Lab., CA (United States). Nov 1991. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-920145–2: Making information work, Washington, DC (United States), 21-23 Jan 1992). Order Number DE92003978. Source: OSTI; NTIS; GPO Dep.

The information model and data analysis and display system for the integrated environmental database, Monitor, developed and used by the Environmental Restoration Division of Lawrence Livermore National Laboratory is discussed in this paper. Types of data stored in the database are enumerated and strategies for their retrieval suggested. The location-based relational information model is explained; location nomenclature is illustrated; treatment of censored analytical data is discussed; the flow of data into the database is outlined. A database/data-analysis integration tool under development is described. 1 fig.

5401 Environmental Sciences, Atmospheric

Refer also to citation(s) 6230, 6242, 6243, 6244, 6245, 6246, 6270, 6271, 6272, 6273, 6274, 6277, 6278, 6283, 6306, 6307, 6460, 6561, 6567, 6568, 6795, 6862, 7477, 7488, 7516, 7540, 7586, 7589, 7616, 7631, 7818, 7819, 8447

7542 (ANL/CP–71762) **Potential changes in atmospheric chemistry in the decades ahead: Climate and biosphere interactions and feedbacks.** Gaffney, J.S.; Marley, N.A. Argonne National Lab., IL (United States). Oct 1991. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-9107104–18: 5. international conference on precipitation scavenging and atmosphere surface exchange process, Richland, WA (United States), 15-19 Jul 1991). Order Number DE92003403. Source: OSTI; NTIS; GPO Dep.

Atmospheric chemistry is a challenging area of research where much knowledge is needed if we are to continue to survive as a species. This paper outlines research needs in the decades ahead in this key area of scientific endeavor. Highlighted are areas of research that are likely to lead to climatic and biospheric impacts and have been given little attention in the past. In particular, the possible organic transformation chemistries that may lead to chemical and physical changes in tropospheric cloud chemistries are highlighted and emphasized as an area where research is needed in the future. 22 refs.

7543 (BNL–46337) **X-ray microprobe studies of Hungarian background and urban aerosols.** Toeroek, S. (Hungarian Academy of Sciences, Budapest (Hungary). Central Research Inst. for Physics); Sandor, S.; Xhoffer, C.; Van Grieken, R.; Jones, K.W.; Sutton, S.R.; Rivers, M.L. Brookhaven National Lab., Upton, NY (United States). Oct 1991. 6p. Sponsored by U.S. DOE Energy Research; Hungarian Academy of Sciences; Government of Belgium. DOE Contract AC02-76CH00016. (CONF-910862–7: Pacific-international congress on x-ray analytical methods, Honolulu, HI (United States), 12-16 Aug 1991). Order Number DE92005001. Source: OSTI; NTIS; GPO Dep.

In order to determine the polluting atmospheric sources in urban and background areas source apportionment of the air particulate matter is necessary. Hitherto these studies were mostly based on bulk composition measurements of the aerosol. Source profiles, i.e. the concentrations of several elements for air particulate matter originating from one source, can be deduced from the receptor data using a number of multivariate techniques among which the chemical mass balance. The application is limited by the large number of observations that must be made for each of the variables. Often an elaborated sample preparation is necessary for fractionating the sample into several sub samples, according to the density, particle diameter or other relevant properties. Often this may results in poorly resolved source profiles. The aim of the present work is to find the relative abundance of the particle types originating from two different background monitoring stations in the middle of the Great Hungarian Plain. In urban areas most pollutants originate from traffic and municipal waste incineration. Since heavy metals play an important role in these samples the highly sensitive x-ray microscope (XRM) of the National Synchrotron Light Source (NSLS) of the Brookhaven National Laboratory was used. A feasibility study on individual aerosol particles sampled at the above background stations and in the urban area of Budapest is discussed.

7544 (DOE/ER–0512T) **Atmospheric Sciences Program: Summaries of research in FY 1991.** USDOE Office of Energy Research, Washington, DC (United States). Office of Health and Environmental Research. Nov 1991. 39p. Sponsored by U.S. DOE

Energy Research. Order Number DE92004111. Source: OSTI; NTIS; GPO Dep.

This document describes the activities and products of the Atmospheric Sciences Program of the Environmental Research, Office of Energy Research, US Department of Energy, in Fiscal Year (FY) 1991. The report is organized into four main sections. Research projects in atmospheric chemistry, atmospheric dynamics and support operations are described. Principal investigators, their institutions, goals, level of effort, and products expected are listed.

7545 (DOE/ER/13772–4) **Kinetics and dynamics of oxidation reactions involving an adsorbed CO species on bulk and supported platinum and copper-oxide: First year annual report, January 1, 1991–December 31, 1991.** Harold, M.P. Massachusetts Univ., Amherst, MA (United States). Dept. of Chemical Engineering. Jul 1991. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER13772. Order Number DE92005077. Source: OSTI; NTIS; GPO Dep.

The proposed research is an integrated experimental and modeling study of oxidation reactions involving CO as a key player – be it a reactant, adsorbed intermediate, and/or partial oxidation product – in the catalytic sequence and chemistry. The reaction systems of interest in the project include CO, formaldehyde, and methanol oxidation by O_2 and CO oxidation by NO, on both Pt and copper oxide catalysts. These reactions are of importance in automobile exhaust catalysis. There is a paucity of rate data in the literature for these important environmental control reactions. The goal of this research is to better understand the catalytic chemistry and kinetics of oxidations reactions involving CO as an adsorbed intermediate. Successfully meeting this goal requires an integration of basic kinetic measurements, in situ catalyst surface monitoring, kinetic modeling, and nonlinear mathematical tools.

7546 (DOE/NV/10630–20-Vol.2) **US Department of Energy, Nevada Operations Office: Annual site environmental report, 1990: Volume 2, Appendices.** McDowell, E.M.; Black, S.C. (eds.). Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (United States). Sep 1991. 253p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC08-89NV10630. Order Number DE92000107. Source: OSTI; NTIS; INIS; GPO Dep.

These appendices contain 1990 Nevada Test Site (NTS) onsite and offsite milk environmental monitoring results. The onsite data presented are accompanied by summaries of statistical evaluations of the data. Other offsite data collected by the EPA are available from the US Environmental Protection Agency, Environmental Monitoring Systems Laboratory, Las Vegas, Nevada. The findings of these monitoring and surveillance efforts are described in volume one of this document. 59 figs., 37 tabs.

7547 (EML–542) **Environmental Measurements Laboratory annual report, 1990.** Chieco, N.A.; Hoppen, J. (eds.). USDOE Environmental Measurements Lab., New York, NY (United States). Nov 1991. 111p. Sponsored by U.S. DOE Energy Research. Order Number DE92004856. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes the activities of the Environmental Measurements Laboratory (EML) for the calendar year 1990 and it serves as an annual report to the Director of the Office of Energy Research (OER), the Associate Director and staff of the Office of Health and Environmental Research (OHER), the manager and staff of the Field Office–Chicago, and our colleagues. Emphasized are the progress and accomplishments of the year, rather than future plans or expectations. The technical summaries are grouped according to the following six general program areas: environmental radiation and radioactivity; radiation transport and dosimetry; environmental radon, thoron, and related aerosols; atmospheric and surface pollutant studies related to global climate change; ecological and subsurface pollutant research; and metrology, consultation, and emergency response.

7548 (EML–543) **Semi-annual report of the Department of Energy Quality Assessment Program.** Sanderson, C.G.; Scarpitta, S.C. USDOE Environmental Measurements Lab., New York, NY (United States). 2 Jan 1992. 119p. Sponsored by U.S. DOE Energy Research. Order Number DE92004855. Source: OSTI; NTIS; GPO Dep.

This report presents the results from the analysis of the 35th set of environmental quality assessment samples (QAP XXXV) that were received on or before December 5, 1991. This Quality Assessment Program (QAP) is designed to test the quality of the environmental measurements being reported to the Department of Energy by its contractors. Since 1976, real or synthetic environmental samples that have been prepared and thoroughly analyzed at the Environmental Measurements Laboratory (EML) have been distributed at first quarterly and then semi-annually to these contractors. Their results, which are returned to EML within 90 days, are compiled with EML's results and are reported back to the participating contractors 30 days later. A summary of the reported results is available to the participants 3 days after the reporting deadline via a modem-telephone connection to the EML computer.

7549 (ENEA-RT-NUCL–90-22) **POLLSIM pollutant material accountancy code.** Dionisi, M.; Remetti, R. ENEA, Casaccia (Italy). Area Nucleare. Sep 1991. 18p. (In Italian). (RT/NUCL–90-22). Order Number DE92743982. Source: OSTI; NTIS (US Sales Only).

A SIMSCRIPT simulation code named POLLSIM was realized in order to test the performance of a pollutant material (e.g., sulfur, cadmium, chromium, fly ash) accountancy system within a material balance area with a one point-like emission source. The reference plant was a 660 MW(e) coal fired power plant with a fuel feeding rate of 200 tonnes/hour of less than 1% sulfur - 15% ash content coal. The main feature of this code is that it integrates continuous simulation with a list of impulsive events such as malfunctions of safeguard systems and/or intentional violations of stack emission rules.

7550 (INIS-mf–12961, pp. 97) **A study on radon concentrations in buildings of the Vienna region in Austria in the winter and summer and an estimation of the resulting effective dose equivalent.** Steger, F. (Oesterreichisches Forschungszentrum Seibersdorf GmbH (Austria)); Hefner, A. Atomic Energy Organization of Iran, Teheran (Iran, Islamic Republic of). Radiation Protection Dept. 1990. 157p. (CONF-9011232–: International conference on high levels of natural radiation, Ramsar (Iran, Islamic Republic of), 3-7 Nov 1990). In *Book of abstracts international conference on high levels of natural radiation Ramsar, Islamic Republic of Iran, 3-7 Nov 1990.* Order Number DE92601158. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. NATURAL RADIOACTIVITY/austria; RADON 222/dose equivalents; BUILDINGS; DAUGHTER PRODUCTS; HUMAN POPULATIONS; INHALATION; AUSTRIA

7551 (ISAS–641) **Electron temperature in the E-region of the ionosphere.** Zalpuri, K.S.; Oyama, K.-I. Institute of Space and Astronautical Science, Sagamihara, Kanagawa (Japan). Jun 1991. 19p. Order Number DE92750870. Source: OSTI; NTIS (US Sales Only); INIS.

Various heating and cooling mechanisms which are operative in the lower E-region are discussed and their relative importance in different altitude range is shown. These heating and cooling rates are then used to derive the electron temperature T_e. The calculated values of electron temperature are found to be higher than neutral temperature through out the altitude range 100 ≈ 150 km, with the difference increasing with increase in altitude. However, compared to observed values of T_e, the calculated values are still smaller below about 130 km. Above this altitude, the calculated values become larger. Estimation of T_e for different, suggested values of heating efficiency due to dissociative recombination, show that T_e profile obtained even be assuming a constant value of 1.3 eV is in fairly good agreement with those derived based on variable values of this parameter. (author).

7552 (Juel–2388) **Investigations on atmospheric dispersion of air pollutants after short-time releases in complex terrain. Third field experiment on atmospheric dispersion around the isolated hill Sophienhoehe in August/September 1988. Methods - experiments - data bank.** Zeuner, G.; Heinemann, K. (eds.); Bahmann, W.; Becker, K.; Frank, J.; Gryning, S.E.; Lyck, E.; Mextorf, O.; Moellmann-Coers, M.; Moenig, C.; Narres, H.D.; Oetz, C.; Oetz, W.; Polster, G.; Veroustraete, F.; Voss, W. Forschungszentrum Juelich GmbH (Germany). Abt. Sicherheit und Strahlenschutz. Sep 1990. 273p. Order Number DE92759209. Source: OSTI; NTIS (US Sales Only).

In order to set up a data bank for the validation of advanced dispersion models, comprehensive meteorological measurements and dispersion experiments in a complex terrain with a well measured topography are being carried out. These investigations have become possible in cooperation with several external groups and with the financial support of the 'Bundesminister fuer Umwelt, Naturschutz und Reaktorsicherheit'. In this report the methods, experiments and results (data bank) of the third field experiment are described. (orig.).

7553 (Juel–2474) **Studies on dust separation in wet scrubbers by water vapour condensation.** Grund, T. Forschungszentrum Juelich GmbH (Germany). Inst. fuer Chemische Technologie; Technische Hochschule Aachen (Germany). May 1991. 126p. (In German). Order Number DE92750127. Source: OSTI; NTIS (US Sales Only).

The off-gas from the incineration of waste and fossil fuels contains numerous gaseous and solid pollutants which must be removed as far as possible from this off-gas by off-gas cleaning. This investigation involved experiments in which very fine dust particles (aerosols) in the particle size range from 0.05 to 6 μm were separated from the gas in a spray washer. The objective was to examine the extent to which dust separation can be improved or simplified by combining it with the condensation of the water vapour present in the exhaust gas. A laboratory facility was constructed for these investgations providing the possibility of comparing various process technologies during condensation in front of and in a wet scrubber while varying the gas parameters of dust content, particle size distribution and water vapour content. The results of the measurements show that not the water content or the condensed water quantity alone is of significance for improving the dust separation by condensation of water vapour. On the contrary, the essential prerequisite is a proper procedure for initiating condensation and the creation of thermodynamic conditions under which a condensation on the aerosols is possible. If these conditions, realizable with existing scrubbers, are achieved then condensation leads to improved dust separation over the entire particle size range. In the experiments improvements of up to 95% or more of the total degree of separation were achieved by condensation in comparison to separtion without condensation. (orig.).

7554 (KFK–4842) **KfK, Institute of Meteorology and Climate Research. Status report on research and development activities in 1990.** Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Meteorologie und Klimaforschung. Mar 1991. 15p. (In German). Order Number DE92759329. Source: OSTI; NTIS (US Sales Only).

The Institute's activities in 1990 included experimental work on the terrestrial surface climate, as well as numerical simulation models for describing and forecasting atmospheric exchange processes in the mesoscale region and a satellite-borne data processing system for remote monitoring of atmospheric parameters. The work on the development of radiation transfer models is described. A list of the Institute's publications in 1990 is enclosed. (KW).

7555 (LA-UR–91-3950) **Global simulations of smoke from Kuwaiti oil fires and possible effects on climate.** Glatzmaier, G.A.; Malone, R.C.; Kao, C.Y.J. Los Alamos National Lab., NM (United States). [1991]. 7p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract W-7405-ENG-36. (CONF-9110127–1: Conference on global climate change: its mitigation through improved production and utilization of energy, Los Alamos, NM (United States), 21-24 Oct 1991). Order Number DE92005068. Source: OSTI; NTIS; GPO Dep.

The Los Alamos Global Climate Model has bee used to simulate the global evolution of the Kuwaiti oil fire smoke and its potential effects on the climate. The initial simulations were done shortly before the fires were lit in January 1991. They indicated that such an event would not result in a "Mini Nuclear Winter" as some people were suggesting. Further simulations during the year suggested that the smoke could be responsible for subtle regional climate changes in the spring such as a 5 degree centigrade decrease in the surface temperature in Kuwait, a 10% decrease in precipitation in Saudi Arabia and a 10% increase in precipitation in the Tibetan Plateau region. These results are in qualitative agreement with the observations this year.

7556 (ORNL/CDIAC–37) **An updated global grid point surface air temperature anomaly data set: 1851–1990.** Sepanski, R.J.; Boden, T.A.; Daniels, R.C. Oak Ridge National Lab., TN (United States). Carbon Dioxide Information Analysis Center. Oct 1991. 5225p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. (NDP–020/R1). Order Number DE92004582. Source: OSTI; NTIS; GPO Dep.

Includes 20 sheets of 24 microfiche supplements. Environmental Sciences Division Publication No. 3520.

This document presents land-based monthly surface air temperature anomalies (departures from a 1951–1970 reference period mean) on a 5° latitude by 10° longitude global grid. Monthly surface air temperature anomalies (departures from a 1957–1975 reference period mean) for the Antarctic (grid points from 65°S to 85°S) are presented in a similar way as a separate data set. The data were derived primarily from the World Weather Records and the archives of the United Kingdom Meteorological Office. This long-term record of temperature anomalies may be used in studies addressing possible greenhouse-gas-induced climate changes. To date, the data have been employed in generating regional, hemispheric, and global time series for determining whether recent (i.e., post-1900) warming trends have taken place. This document also presents the monthly mean temperature records for the individual stations that were used to generate the set of gridded anomalies. The periods of record vary by station. Northern Hemisphere station data have been corrected for inhomogeneities, while Southern Hemisphere data are presented in uncorrected form. 14 refs., 11 figs., 10 tabs.

7557 (PNL–6450-47-HEDR) **Hanford Environmental Dose Reconstruction Project: Monthly report.** Pacific Northwest Lab., Richland, WA (United States). Sep 1991. 73p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE92003961. Source: OSTI; NTIS; GPO Dep.

The objective of the Hanford Environmental Dose Reconstruction Project is to estimate the radiation dose that individuals and populations could have received from nuclear operations at Hanford since 1944. The project is divided into five technical tasks. These tasks correspond to the path radionuclides followed, from release to impact on humans (i.e., dose estimates). The Source Terms Task develops estimates of radioactive emissions from Hanford facilities since 1944. The Environmental Transport Task reconstructs the movements of radioactive particles from the areas of release to populations. The Environmental Monitoring Data Task assemblies, evaluates and reports historical environmental monitoring data. The Demographics, Agriculture and Food Habits Task develops the data needed to identify the populations that could have been affected by the releases. The Environmental Pathways and Dose Estimates Task used the information derived from the other Tasks to estimate the radiation doses individuals could have received from Hanford radiation. This document lists the progress on this project as of September 1991. 3 figs., 2 tabs.

7558 (PNL–7781) **Generator, mechanical, smoke: For dual-purpose unit, XM56, Yuma Proving Ground, Yuma, Arizona: Environmental assessment.** Driver, C.J. (Pacific Northwest Lab., Richland, WA (United States)); Ligotke, M.W.; Moore, E.B. Jr.; Bowers, J.F. Pacific Northwest Lab., Richland, WA (United States). Oct 1991. 40p. Sponsored by U.S. Department of Defense. DOE Contract AC06-76RL01830. Order Number DE92001826. Source: OSTI; NTIS; GPO Dep.

The US Army Chemical Research, Development and Engineering Center (CRDEC) is planning to perform a field test of the XM56 smoke generator at the US Army Yuma Proving Ground (YPG), Arizona. The XM56, enabling the use of fog oil in combination with other materials, such as graphite flakes, is part of an effort to improve the efficiency of smoke generation and to extend the effectiveness of the resulting obscurant cloud to include the infrared spectrum. The plan field operation includes a road test and concurrent smoke- generation trials. Three M1037 vehicles with operation XM56 generators will be road-tested for 100 h. Smoke will be generated for 30 min from a single stationary XM56 four times during the road test, resulting in a total of 120 min of smoke generation.

The total aerial release of obscurant materials during this test is expected to be 556 kg (1,220 lb) of fog oil and 547 kg (1,200 lb) of graphite flakes. This environmental assessment has evaluated the consequences of the proposed action. Air concentrations and surface deposition levels were estimated using an atmospheric dispersion model. Degradation of fog oil and incorporation of graphite in the soil column will limit the residual impacts of the planned action. No significant impacts to air, water, and soil quality are anticipated. risks to the environment posed by the proposed action were determined to be minimal or below levels previously found to pose measurable impacts. Cultural resources are present on YPG and have been identified in adjacent areas; therefore, off-road activities should be preceded by a cultural resource survey. A Finding of No Significant Impact is recommended. 61 refs., 1 fig.

7559 (PNL–7868-HEDR) **Letter report: References for radioactive releases to the atmosphere from Hanford operations, 1944–1957: Hanford Environmental Dose Reconstruction Project.** Hall, R.B. Pacific Northwest Lab., Richland, WA (United States). Nov 1991. 19p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE92004640. Source: OSTI; NTIS; GPO Dep.

A search was made for published documents related to discharges of radioactive material from Hanford Site facilities to the atmosphere from 1944–1957. The purpose was to list documents that contain data that might be useful in developing a source term for airborne releases. The source term for the radionuclide that contributes most to dose, ioidine-131, is a separate effort. Other source terms will be developed later. This tabulation of published summaries of atmospheric release data shows the type of measurements that were being made from 1944–1957 and the magnitude of the discharges to the atmosphere. In the early years, very little data were collected that related to specific radionuclides. However, most of the key radionuclides were known to be present in effluents from occasional specific radionuclide analyses. 2 refs.

7560 (PNL–7964) **Environmental surveillance master sampling schedule.** Bisping, L.E. Pacific Northwest Lab., Richland, WA (United States). Jan 1992. 57p. Sponsored by U.S. DOE Environment Safety & Health. DOE Contract AC06-76RL01830. Order Number DE92005356. Source: OSTI; NTIS; GPO Dep.

Environmental surveillance of the Hanford Site and surrounding areas is conducted by the Pacific Northwest Laboratory (PNL) for the US Department of Energy (DOE). This document contains the planned schedule for routine sample collection for the Surface Environmental Surveillance Project (SESP) and Ground-Water Monitoring Project. Samples for radiological analyses include Air-Particulate Filter, gases and vapor; Water/Columbia River, Onsite Pond, Spring, Irrigation, and Drinking; Foodstuffs/Animal Products including Whole Milk, Poultry and Eggs, and Beef; Foodstuffs/Produce including Leafy Vegetables, Vegetables, and Fruit; Foodstuffs/Farm Products including Wine, Wheat and Alfalfa; Wildlife; Soil; Vegetation; and Sediment. Direct Radiation Measurements include Terrestrial Locations, Columbia River Shoreline Locations, and Onsite Roadway, Railway and Aerial, Radiation Surveys.

7561 (UCRL-JC–106109-Rev.1) **A numerical model of aerosol scavenging: Part 1, Microphysics parameterization.** Molenkamp, C.R.; Bradley, M.M. Lawrence Livermore National Lab., CA (United States). Sep 1991. 16p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9107104–19-Rev.1: 5. international conference on precipitation scavenging and atmosphere surface exchange process, Richland, WA (United States), 15-19 Jul 1991). Order Number DE92004665. Source: OSTI; NTIS; GPO Dep.

We have developed a three-dimensional numerical model (OCTET) to simulate the dynamics and microphysics of clouds and the transport, diffusion and precipitation scavenging of aerosol particles. In this paper we describe the cloud microphysics and scavenging parameterizations. The representation of cloud microphysics is a bulk- water parameterization which includes water vapor and five types of hydrometeors (cloud droplets, rain drops, ice crystals, snow, and graupel). A parallel parameterization represents the scavenging interactions between pollutant particles and hydrometeors including collection of particles because of condensation nucleation, Brownian and phoretic attachment, and inertial capture, resuspension because of evaporation and sublimation; and transfer interactions where particles collected by one type of hydrometeor are transferred to another type of freezing, melting, accretion, riming and autoconversion.

7562 (UCRL-JC–106966-Rev.1) **Drop size distributions and the efficiency of nucleation scavenging over the Hardiman fire: Revision 1.** Chuang, C.C.; Penner, J.E.; Edwards, L.L. Lawrence Livermore National Lab., CA (United States). Oct 1991. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9107104–2-Rev.1: 5. international conference on precipitation scavenging and atmosphere surface exchange process, Richland, WA (United States), 15-19 Jul 1991). Order Number DE92004663. Source: OSTI; NTIS; GPO Dep.

A prescribed burn experiment was conducted in Hardiman Township, Ontario, Canada in August 1987. The fire was of adequate intensity to force the formation of a cumulus cloud, and much of the smoke passed through this cloud. The evolution of the smoke and drop size distributions within this fire-driven cloud due to nucleation and condensation was calculated by a detailed microphysical entraining model. We investigate the sensitivity of nucleation scavenging and drop number concentration to the different environmental aerosol distributions. The predicted drop size distribution and the measured data above the fire are in good agreement for drop sizes which correspond to condensation on the measured smoke spectra. The results from this study can be used to develop a parameterization that relates the drop number to the updraft velocity and the aerosol number at cloud base. We plan to extend this study to predict the effects of aerosols on drop spectra for use in climate models.

7563 (UCRL-JC–108038-Rev.1) **Impact of reactive nitrogen emissions from fossil fuel combustion and biomass burning on atmospheric chemistry: Revision 1.** Dignon, J.; Penner, J.E.; Atherton, C.S.; Walton, J.J. Lawrence Livermore National Lab., CA (United States). Sep 1991. 28p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-910809–2-Rev.1: International symposium on energy and environment, Espoo (Finland), 25-28 Aug 1991). Order Number DE92003544. Source: OSTI; NTIS; GPO Dep.

In this study, using a Lagrangian chemical-transport-deposition model adapted to the nitrogen cycle, we will look at all of the known sources of nitrogen oxides, both natural and man-made. We will attempt to quantify the relative affect that man made sources including fossil fuel and biomass burning have had on the nitrogen cycle and the chemistry of the atmosphere throughout the globe. (JL)

7564 (UCRL-JC–108318) **Greenhouse gases: Sources and emissions.** Edmonds, J. (Pacific Northwest Lab., Richland, WA (United States)); Wuebbles, D.J. Lawrence Livermore National Lab., CA (United States). 30 Mar 1991. 30p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-7405-ENG-48 ;AC06-76RL01830. (CONF-910405–2: World Coal Institute conference and exhibition on coal in the environment, London (United Kingdom), 3-5 Apr 1991). Order Number DE92004672. Source: OSTI; NTIS; GPO Dep.

The current interest in the "greenhouse" issue stems from the observation that the concentrations of such gases as CO_2, CH_4, N_2O, $CFCl_3$ and CF_2Cl_2 have been increasing. Changes in the concentrations of these gases hold the potential for changing the Earth's climate. In the discussion that follows, we will examine recent and long-term trends in the atmosphere, and the current understanding of the sources of the most important radiatively important gases released as byproducts of human activities. These gases are: CO_2, CH_4, N_2O, CFCs, and CO. In addition we will discuss the current outlook for future emissions of these gases and the current understanding of the technical potential and economic costs of options to reduce emissions of these gases. This suite of gases includes both the greenhouse gases as well as those gases which can either directly or indirectly affect the Earth's energy balance. 65 refs., 6 tabs.

7565 (WHC-EP–0536) **Quality Assurance Program Plan for radionuclide airborne emissions monitoring.** Vance, L.W. Westinghouse Hanford Co., Richland, WA (United States). Dec

1991. 139p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-87RL10930. Order Number DE92005280. Source: OSTI; NTIS; INIS; GPO Dep.

This Quality Assurance Program Plan (QAPP) describes how the Environmental, Safety, Health, and Quality Assurance Division verifies that radioactive airborne emission measurement activities from regulated stacks are controlled at the Hanford Site. Detailed monitoring requirements apply to stacks exceeding 1% of the standard of 10 mrem annual effective dose equivalent to the maximally exposed individual from operations of the Hanford Site.

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Refer also to citation(s) 6248, 6249, 6306, 6307, 6379, 6390, 6392, 6409, 6410, 6412, 6413, 6418, 6428, 6453, 6456, 6458, 6460, 6472, 6689, 6776, 6777, 6778, 7516, 7546, 7548, 7557, 7558, 7560, 7615, 7618, 7621, 7628, 7631, 7632, 7681, 7682, 7683, 7809, 7810, 7811, 7818, 7821, 8381, 8447

7566 (ANL/CP-73172) **Ultrasonic process for detoxification of groundwater.** Wu, Jiann M.; Huang, H.S.; Livengood, C.D. Argonne National Lab., IL (United States). [1991]. 33p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract W-31109-ENG-38. (CONF-911133–8: American Institute of Chemical Engineers (AIChE) annual meeting, Los Angeles, CA (United States), 17-22 Nov 1991). Order Number DE92004142. Source: OSTI; NTIS; INIS; GPO Dep.

In this paper, we present the results of an investigation of the ultrasonic irradiation of carbon tetrachloride at various pH values, temperatures, and power intensities. Kinetic data and selected chemical mechanism are discussed and proposed. To study oxidant efficiency, chemical oxidants, such as hydrogen peroxide, are also considered. This work is part of a project entitled "Ultrasonic Process for Detoxification of Groundwater and Soil," sponsored by the US Department of Energy, Office of Technology Development, to develop an innovative process for the effective destruction of chlorinated organics in soil and groundwater.

7567 (CNIC–00413) **The migration, accumulation and distribution of ^{59}Fe in rice plants and soils.** Wang Yumin (Chinese Academy of Agricultural Sciences, Beijing, BJ (China). Inst. for Application of Atomic Energy); Xu Shiming; Xu Guanren. China Nuclear Information Centre, Beijing, BJ (China). Jul 1990. 15p. (In Chinese). (CSNAS–0032.). Order Number DE92613453. Source: OSTI; NTIS (US Sales Only); INIS.

The ^{59}Fe is one of radionuclides in the waste water discharged from nuclear power plants. The accumulation and distribution of ^{59}Fe in rice plants at different growing stages and the accumulation and migration in soils of different textures were studied by using solution containing $^{59}FeCl_3$ as a tracer. At the same contaminated activity, the distribution in the soils are discussed. According to the biological consequences caused by ^{59}Fe entering indirectly into agroecological environment, the possible methods for treatment and utilization of agricultural products are suggested.

7568 (CNIC–00419) **Natural radionuclides in phosphatic fertilizer and their behaviour of absoption and accumulation in soils and crops.** Chen Jingjian (Chinese Academy of Agricultural Sciences, Beijing, BJ (China). Inst. of Application of Atomic Energy); Zhu Yongyi; Yang Juncheng; Gu Baming. China Nuclear Information Centre, Beijing, BJ (China). Jun 1990. 16p. (In Chinese). (CSNAS–0033.). Order Number DE92613454. Source: OSTI; NTIS (US Sales Only); INIS.

The systematic data on the radioactivity of U, Th, Ra and ^{40}K in phosphate rocks, phosphatic fertilizers and soil are given. The radioactive composition and radioactivity in phosphatic fertilizers vary with different kinds of phosphatic fertilizers. The radioactive compositions in the phosphatic fertilizers made from phosphate rock are the same as that in the original phosphate rock, but the radioactivity is only 50$\approx$60% of the original. The natural uranium in the compound fertilizer made from phosphoric acid is several times higher than that in the phosphate rock, and the other radionuclides were separated during the process of forming phosphoric acid. In soil, the radioactivity varies with the soil types. The U content is slightly higher in the south region with red earth and the ^{40}K is higher in the north region with black earth, but all are in normal level. Usually, the radioactivity of phosphate rock and phosphatic fertilizer is between the natural background of soil and the limitation of radioactive protection, but the radioactivity of ^{226}Ra in some phosphate rocks and phosphatic fertilizers in Guizhou and Hunan is higher than the permitted limitation set by the government.

7569 (CONF-9106315–1) **The influence of surfactant sorption on capillary pressure-saturation relationships.** Desai, F.N.; Demond, A.H.; Hayes, K.F. Michigan Univ., Ann Arbor, MI (United States). Dept. of Civil and Environmental Engineering. [1991]. 25p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-89ER60820. From 65. annual colloid and surface science symposium; Norman, OK (United States); 17-19 Jun 1991. Order Number DE92004336. Source: OSTI; NTIS; GPO Dep.

The capillary pressure-saturation relationship, a fundamental relationship in the description of multiphase flow, depends on the interfacial properties of the system. Sorption of a cationic surfactant such as cetyltrimethylammonium bromide (CTAB) at the various interfaces of a system changes interfacial properties such as electrophoretic mobility, interfacial tensions, and contact angle. The objective of this paper is to examine the effect of the changes in these interfacial properties on the capillary pressure-saturation relationships for the air-water-silica system. The results presented here show that as the sorption of CTAB increases, the naturally negatively-charged silica surface becomes positively charged. This change in charge is reflected in the contact angle which passes through a maximum when the electrophoretic mobility is close to zero. The spontaneous imbibition capillary pressure relationship is more sensitive to changes in interfacial properties than the drainage relationship. In the air-water-silica system studied here, no imbibition is observed at the maximum contact angle. The surface tension and contact angle can be used to predict both the drainage and imbibition relationships of the air-water-silica-CTAB systems from that of the air-water-silica system. The prediction is accomplished through scaling using the value of surface tension and the operational contact angle, which can be obtained from the intrinsic angle through the incorporation of corrections for roughness and interfacial curvature. A comparison of the measured and calculated capillary pressure relationships shows that it is possible to predict the effect of surfactant sorption on both drainage and imbibition capillary pressure-saturation relationships for the system studied.

7570 (CONF-9109234–7) **Use of electromagnetic borehole flowmeter to delineate groundwater producing fractures.** Nyquist, J.E. (Oak Ridge National Lab., TN (United States)); Moore, G.K.; Clapp, R.B.; Young, S.C. Oak Ridge National Lab., TN (United States). [1991]. 5p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC05-84OR21400. From 4. Tennessee water resources symposium; Knoxville, TN (United States); 24-26 Sep 1991. Order Number DE92003559. Source: OSTI; NTIS; GPO Dep.

Ground water flow on the Oak Ridge Reservation (ORR) is dominated by permeable fractures within the relatively impermeable rocks. It is possible to detect the fractures which intersect a borehole using conventional logging tools (electrical, sonic, acoustic televiewer, caliper, temperature), but not with any certainty which of these fractures are permeable and are part of a connected network. This poses a problem for the groundwater modeler. Should all known fractures be included in the model? Only major fractures?

7571 (CONF-9111158–1) **Supercritical fluid extraction and organic solvent microextraction of chemical agent simulants from soil.** Griest, W.H.; Ramsey, R.S.; Ho, C.h.; Caldwell, W.M. Oak Ridge National Lab., TN (United States). [1991]. 8p. Sponsored by U.S. Department of Defense. DOE Contract AC05-84OR21400. Contract IAG 1989-C110-A1. From 1991 U.S. Army chemical research conference on chemical defense; Aberdeen Proving Ground, MD (United States); 19-22 Nov 1991. Order Number DE92004442. Source: OSTI; NTIS; GPO Dep.

Experiments with chemical warfare agent simulants suggest that supercritical fluid extraction can achieve good extraction recoveries of agents in soil and produce less laboratory waste than current organic solvent extraction methods. Two-ppm spikes in 1 g of Rocky Mountain Arsenal Standard Soil were extracted using 5% methanol in carbon dioxide at 300 atm for 2 min at 60°C. Recoveries (n=3) were 79±23% for dimethylmethylphosphonate, 93±14% for 2-chlorethylethylsulfide, 92±13% for diisopropylfluorophosphate, and 95±17% for diisopropylmethylphosphonate. A 5 min ultrasonic micro-scale extraction using methanol is more reproducible but less efficient.

7572 (DOE/ER/60820–2) **The influence of interfacial properties on two-phase liquid flow of organic contaminants in groundwater: Progress report, January 1, 1991–September 31, 1991.** Hayes, K.F.; Demond, A.H. Michigan Univ., Ann Arbor, MI (United States). Sep 1991. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-89ER60820. Order Number DE92004685. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this project is to investigate how changes in interfacial chemical properties affect two-phase transport relationships. Specifically, the objective is to develop a quantitative means that will enable the prediction of changes in the capillary pressure-saturation relationship, a fundamental constitutive relationship in multiphase flow, from changes in interfacial properties, such as adsorption and electrophoretic mobility, through a knowledge of their effect on wettability. The information presented here summarizes the progress we have made in the past eight months of the second project period. Working with a system composed of air-water-silica-cetyltrimethylammonium bromide (CTAB), we have obtained a relationship between degree of adsorption and the surface charge of silica (as measured by electrophoretic mobility), and the drainage and imbibition capillary pressure relationships of system. The bulk of this report describes the completed set of measurements for the air-water-silica-CTAB system at pH 6. We are currently working on a comparable set of measurements for the xylene-water-silica-CTAB system at pH 6. Described here are the interfacial tension, contact angle and preliminary drainage capillary pressure measurements. Our work to date shows a dependence of surface properties on pH. Consequently, in the coming year, we will also complete a set of measurements at another pH value to show the effect of pH on capillary pressure relationships.

7573 (DOE/ER/60845–2) **Adsorption of chromate/organic-acid mixtures in aquifer materials: Technical progress report, 1 July 1990–30 June 1991.** Fish, W.; Palmer, C.D. Oregon Graduate Inst. of Science and Technology, Beaverton, OR (United States). Dept. of Environmental Science and Engineering. 15 Jul 1991. 22p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-89ER60845. Order Number DE92004390. Source: OSTI; NTIS; GPO Dep.

The overall objective of this project is to develop a fuller understanding of the interactions of mixtures of anionic co-contaminants with oxide-mineral surfaces. Our specific focus is on the competitive interactions of chromate and oxalic acid on ferric oxyhydroxide and on natural aquifer materials. Chromate and oxalate are of practical interest as widespread contaminants at many DOE facilities. However, these anions also are excellent model adsorbates for elucidating fundamental aspects of ionic adsorption processes, particularly with respect to organic acids.

7574 (DOE/ER/60946–2) **Reductive mobilization of oxide-bound metals: Progress report, November 1, 1990–September 15, 1991.** Stone, A.T. Johns Hopkins Univ., Baltimore, MD (United States). Dept. of Geography and Environmental Engineering. [1991]. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-90ER60946. Order Number DE92004040. Source: OSTI; NTIS; GPO Dep.

We have completed a large number of experiments which examine the release of MnO_2-bound Co, Ni, and Cu. Our work has focused upon the following areas: (1) competitive adsorption among the three toxic metals and Mn(II); (2) toxic metal release upon addition of low MW organic reductants and complexants; and (3) toxic metal release upon addition of natural organic matter-rich surface waters and IHSS organic matter reference material.

7575 (DOE/OR/00033–T456) **Screening assessment from potential exposure to ^{137}Cs, ^{60}Co and ^{90}Sr in the upper floodplain of White Oak Lake.** Ghiron, J.A. Florida Univ., Gainesville, FL (United States). 1991. 106p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-76OR00033. Order Number DE92004764. Source: OSTI; NTIS; INIS; GPO Dep.

In 1943, Oak Ridge National Laboratory formed White Oak Lake, a small shallow retention basin for their treated and untreated liquid waste. The waste flowed into White Oak Lake, where it was retained for a period of time, and most of the radioactive contaminants settled out, accumulating in the lake bed. Currently, the lake is being maintained at a lower level than in the past. Consequently, sections of the old lake bed are presently exposed as an upper floodplain. A preliminary screening assessment was performed on the upper floodplain of White Oak Lake to identify the radionuclides of concern, quantify the potential risk to human health, and rank potential contaminants of concern. From the screening criteria applied in this assessment, ^{137}Cs in the external pathway and in the ingestion pathway was identified as a high priority contaminant. The external and ingestion pathways were identified as pathways of concern that need to be addressed in further investigations. Screening did not identify the inhalation pathway as a potential pathway of concern. It is recommended that when the health risk assessment is conducted, emphasis should be placed on investigating the potential exposures from ^{137}Cs in the external and ingestion pathways.

7576 (DOE/OR/00033–T457) **Hazard ranking systems for chemical wastes and chemical waste sites: Hazardous waste ranking systems.** Waters, R.D. (Vanderbilt Univ., Nashville, TN (United States)); Parker, F.L.; Crutcher, M.R. Vanderbilt Univ., Nashville, TN (United States). [1991]. 78p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-76OR00033. Order Number DE92004765. Source: OSTI; NTIS; INIS; GPO Dep.

Hazardous materials and substances have always existed in the environment. Mankind has evolved to live with some degree of exposure to toxic materials. Until recently the risk has been from natural toxins or natural background radiation. While rapid technological advances over the past few decades have improved the lifestyle of our society, they have also dramatically increased the availability, volume and types of synthetic and natural hazardous materials. Many of their effects are as yet uncertain. Products and manufacturing by-products that no longer serve a useful purpose are deemed wastes. For some waste products land disposal will always be their ultimate fate. Hazardous substances are often included in the waste products. One needs to classify wastes by degree of hazard (risk). Risk (degree of probability of loss) is usually defined for risk assessment as probability of an occurrence times the consequences of the occurrence. Perhaps even more important than the definition of risk is the choice of a risk management strategy. The choice of strategy will be strongly influenced by the decision criteria used. Those decision criteria could be utility (the greatest happiness of the greatest number), rights or technology based or some combination of the three. It is necessary to make such choices about the definition of risks and criteria for management. It is clear that these are social (i.e., political) and value choices and science has little to say on this matter. This is another example of what Alvin Weinberg has named Transcience where the subject matter is scientific and technical but the choices are social, political and moral. This paper shall deal only with the scientific and technical aspects of the hazardous waste problem to create a hazardous substances classification system.

7577 (DOE/OR/21548–194) **Quarry residuals RI/FS scoping document: Weldon Spring Site Remedial Action Project.** MK-Ferguson Co., St. Charles, MO (United States); Jacobs Engineering Group, Inc., St. Charles, MO (United States). Oct 1991. 57p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-86OR21548. Order Number DE92001850. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this document is to serve as a planning tool for the implementation of the Quarry Residual Remedial Investigation/Feasibility Study (RI/FS) process and to provide direct input to revising and updating the 1988 Work Plan for the Weldon Spring Site Remedial Action Project (WSSRAP) Remedial Investigation/Feasibility Study-Environmental Impact Statement for the Weldon Spring Site (RI/FS-EIS) (Peterson et al. 1988) for this effort. The scoping process is intended to outline the tasks necessary to develop and implement activities in compliance with the Comprehensive Environmental Response, Compensation and Liability Act-National Environmental Policy Act (CERCLA-NEPA) process from detailed planning through the appropriate decision document. In addition to scoping the entire process, this document will serve as the primary tool for planning and accomplishing all activities to be developed in the Quarry Residual RI/FS Work Plan. Subsequent tasks are difficult to plan at this time. 10 refs., 5 figs., 5 tabs.

7578 (EGG–10617-1080) **An aerial radiological survey of the West Valley Demonstration Project and surrounding area, West Valley, New York: Date of survey, August–September 1984.** Berry, H.A. EG and G, Inc., Las Vegas, NV (United States). Remote Sensing Lab. Sep 1991. 19p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC08-88NV10617. Order Number DE92003606. Source: OSTI; NTIS; INIS; GPO Dep.

An aerial radiological survey of the West Valley Demonstration Project and the surrounding area was conducted from mid-August through early September 1984 by EG&G Energy Measurements, Inc. for the United States Department of Energy. The radiological survey was part of the United States Department of Energy Comprehensive Integrated Remote Sensing (CIRS) program, which provides state-of-the-art remote sensing to support the needs of the various DOE facilities. The survey consisted of airborne measurements of both natural and man-made gamma radiation emanating from the terrestrial surface. These measurements allowed an estimate of the distribution of isotopic concentrations in the area surrounding the project site. Results are reported as isopleths superimposed on aerial photographs of the area. Gamma ray energy spectra are also presented for the net man-made radionuclides. 8 refs., 16 figs., 9 tabs.

7579 (EGG–10617-1132) **An aerial radiological survey of the Saxton Nuclear Experimental Corporation facility and surrounding area, Saxton, Pennsylvania: Date of survey: July 1989.** Hoover, R.A. EG and G Energy Measurements, Inc., Las Vegas, NV (United States). Remote Sensing Lab. Oct 1991. 12p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC08-88NV10617. Order Number DE92004702. Source: OSTI; NTIS; INIS; GPO Dep.

An aerial radiological survey was conducted during the period July 5 to 22, 1989, over an 83-square kilometer (32-square-mile) area surrounding the Saxton Nuclear Experimental Corporation (SNEC) facility which is owned by General Public Utilities and located near Saxton, Pennsylvania. The survey was conducted at a nominal altitude of 61 meters (200 feet) with line spacings of 91 meters (300 feet). A contour map of the terrestrial gamma exposure rate extrapolated to 1 meter above ground level (AGL) was prepared and overlaid on an aerial photograph and a set of United States Geological Survey (USGS) topographic maps of the area. The terrestrial exposure rates varied from about 9 to 11 microroentgens per hour (μR/h) over most of the survey area. The levels over the SNEC family did not differ from the exposure rates seen over the entire survey area. Cesium-137 (Cs-137) levels typical of worldwide fallout deposition were detected throughout the surveyed area. No other trends of Cs-137 were observed. Soil samples and pressurized ion chamber measurements were obtained at six locations within the survey boundaries to support the aerial data.

7580 (ETDE-IT–91-83) **Determination of experimental parameters for evaluating release of contaminants and their interaction with environment at waste disposal site.** Balzamo, S.; De Angelis, G.; Marchetti, A. ENEA, Casaccia (Italy). Centro Ricerche Energia. May 1991. 12p. (CONF-910508–2: Joint international symposium on the environmental consequences of different waste disposal, Stockholm (Sweden), 27-31 May 1991). Order Number DE92744000. Source: OSTI; NTIS (US Sales Only).

From Joint international symposium on environmental consequences of hazardous waste disposal; Stockholm, Sweden (27-31 May 1991).

A research programme has been undertaken at ENEA with the financial support of the Ministry for the Environment in the aim at evaluating the environmental impact of hazardous waste disposal. Experimental tests have been carried out in order to obtain a series of data on which models for the prediction of future contamination are based, in the frame of such programme. The release of toxic elements from solidified wastes, as well as the release mechanisms, were evaluated. The interaction between conditioned wastes and soil was assessed in labo. scale with the help of lysimeters using siliceous sand or natural pozzolan as simultants of ground soil. Moreover, the relative mobility of different cations travelling through the soil was determined by measuring the linear distribution coefficient. Finally the permeabilities of both conditioned waste and backfill material were taken into account and related to each other. Due to the strict relationship existing between water permeability and cement capillary pores, measurements of cement porosity by mercury intrusion porosimetry were also performed.

7581 (GSF–41/90) **Radioactivity levels of trees before and after the Chernobyl reactor accident as well as in vitro determinations of cesium to evaluate leaf uptake and deep zone distribution in adaxial leaf cuticles.** Ertel, J. (GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Inst. fuer Strahlenschutz). GSF - Forschungszentrum fuer Umwelt und Gesundheit GmbH, Neuherberg (Germany). Dec 1990. 203p. (In German). Order Number DE92750155. Source: OSTI; NTIS (US Sales Only); INIS.

It was the aim of the study described here to investigate into radionuclide concentrations in various species of trees encountered in forests that are detectable over prolonged periods of time after the Chernobyl accident. Separate radionuclide measurements for the individual tree organs (leaves, needles and branches of different ages, wood, fruit and semen) permitted conclusions to be drawn as to the fate of the isotopes under investigation. A survey is given of the distribution of invading radionuclides, changes over time and their migration into newly grown parts of trees. The findings are evaluated in the context of measurements made in comparable samples obtained before the Chernobyl accident. (orig.).

7582 (IAEA-R–5060-F) **Natural production long-lived radionuclides in geological formations: Final report for the period 15 April 1988 - 31 August 1991.** Florkowski, T. International Atomic Energy Agency, Vienna (Austria). Sep 1991. 33p. Order Number DE92613458. Source: OSTI; NTIS (US Sales Only); INIS.

The natural production of radionuclides in the geosphere is of importance in studies of the residence time of old groundwater as well as in the determination of the migration rates of long-lived radio-nuclides from underground disposal sites of radioactive waste. Estimation of production rates of radionuclides originating in the spontaneous fission of uranium (e.g. ^{81}Kr, ^{129}I, ^{99}Tc), or in reactions with thermal neutrons (e.g. ^{36}Cl), has been described in a number of publications. The method of determining the neutron energy spectrum in various types of rock and the calculation of production rates and equilibrium concentrations of certain radionuclides are known for some elements. Estimation of the production of nuclides in nuclear reactions with fast neutrons in the rock formation is possible when the neutron energy distribution is known. One of the best possible approaches to this question is by application of a multigroup diffusion approximation. The main limitation of this estimation is the necessary assumption of the homogeneity of the distribution of all elements in the rock matrix. The mineralogical structure of the rock, as well as the fact that uranium and thorium-rich minerals are often concentrated close to the fracture zones and microfissures, plays an important role in the mechanism of neutron production yields and possibly in the production of ^{239}Pu. Nevertheless, even this simplified approach is helpful in estimating the production rates of interesting nuclides. Refs, figs and tabs.

7583 (JAERI-M–91-118) **Experimental method for determining distribution coefficients of TRU nuclides for evaluating their migration behaviors.** Tanaka, Tadao (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Kamiyama, Hideo. Japan Atomic Energy Research Inst., Tokyo (Japan). Aug 1991. 19p. (In Japanese). Order Number DE92750952. Source: OSTI; NTIS (US Sales Only); INIS.

Distribution coefficients of americium and plutonium were measured by batch experiments for typical geological formations at Shimokita area in Aomori prefecture, sand stone, tuff rock and sandy soil. The distribution coefficients of both nuclides were largely affected by pH of the used synthetic ground water as well as by the separating condition of solid-liquid phase. It has been shown that their distribution coefficients are varied by their transfer route among geological formations, since their chemical species, which can move through a certain geological formation, are depending on its pore size and the pH of infiltrating water in it. It was concluded that consideration on the structure of geological formations and their physico-chemical properties should be taken in the measurement of effective distribution coefficients for evaluating the migration behavior of TRU nuclides. (author).

7584 (KAERI-II/RR–5/90) **Evaluation of structural behavior, geological and hydrogeological characteristics: A dynamic behavior study of rock caverns considering the effects of discontinuities.** Kim, Jhin Wung (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Kim, Sun Hoon; Choi, Kyu Sup; Lee, Kyung Jin; Kim, Dae Hong. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Feb 1991. 107p. (In Korean). Order Number DE92614882. Source: OSTI; NTIS (US Sales Only); INIS.

The structural behavior of radioactive waste disposal facilities may be greatly influenced by earthquakes through ground shaking and earthquake-induced ground evaluation of radioactive waste repositories. Therefore, a comprehensive understanding of computational models considering the effects of discontinuities and an improvement of structural analysis methods are essential in order to predict properly the dynamic behavior of underground rock caverns subjected to seismic loadings. The purpose of this study is to examine the structural behavior of rock cavern within discontinuous rock masses subjected to dynamic loadings with the objective that the results of this study will become a basis for understanding the effects of ground motion associated with earthquakes on underground radioactive waste disposal facilities. This report is divided into three parts. In the first part, computational models for discontinuous rock masses and equations of motion for a rigid block model are discussed. In the second part, the distinct element program written for the static and dynamic analysis of discontinuous rock masses is presented. A few practical examples of structural analyses of rock caverns within discontinuous rock masses subjected to dynamic loadings using the distinct element computer program are presented in the third part of this report. (Author).

7585 (KFK–4906) **Estimation of the temperature structure parameter and the sensible heat flux from SODAR measurements.** Gentou, H.; Kalthoff, N.; Thomas, P.; Vogt, S. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Meteorologie und Klimaforschung. Aug 1991. 32p. Order Number DE92759286. Source: OSTI; NTIS (US Sales Only).

A commercially available Doppler-SODAR and a sonic anemometer-thermometer have been operated during June and July 1990 at the Nuclear Research Center Karlsruhe to mesure backscattered echo, the wind vector, the standard deviation of the vertical wind speed and sonic data like the heat flux. Other meteorological parameters have additionally been measured by the SODAR, the sonic instrument at 100 m AGL, and at a 200 m high tower at which the sonic instrument was installed. Temperature structure parameters derived from SODAR backscattering echo and from sonic anemometer-thermometer data using mixed layer similarity relationship are compared and show fairly good correlation. Measurements of the SODAR backscattered echo and standard deviation of the vertical wind speed are each used to estimate the sensible heat flux in the convective Planetary Boundary Layer. Comparison with simultaneous point measurement by the eddy correlation method shows good agreement between the two instruments. (orig.).

7586 (ORNL/M–1157) **Environmental surveillance data report for the fourth quarter of 1990.** Goldberg, P.Y.; Horwedel, B.M.; Loffman, R.S.; Osborne-Lee, A.E.; Powell, M.R.; Stevens, M.M.; Tardiff, M.F.; Valentine, C.K.; Wolf, D.A. Oak Ridge National Lab., TN (United States). Jan 1992. 129p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE92005089. Source: OSTI; NTIS; INIS; GPO Dep.

The Environmental Surveillance and Protection Section within the Office of Environmental and Health Protection at the Oak Ridge National Laboratory (ORNL) is responsible for the development and implementation of an environmental program to (1) ensure compliance with all federal, state, and Department of Energy (DOE) reporting requirements to quantitatively demonstrate prevention, control, and abatement of environmental pollution; (2) monitor the adequacy of containment and effluent controls; and (3) assess impacts of releases from ORNL facilities on the environment. Environmental monitoring, as defined by Draft DOE Order 5400.6, consists of two major activities: effluent monitoring and environmental surveillance. Effluent monitoring is the collection and analysis of sample or measurements of liquid and gaseous effluents. Environmental surveillance is the collection and analysis of samples, or direct measurements, of air, water, soil, foodstuff, biota, and other media from DOE sites and their environs. Monthly or quarterly summaries are presented in this report for each media sampled. All data are rounded to two significant digits. The summary tables generally give the number of samples collected during the period and the maximum, minimum, average, and standard error of the mean (SE) values of parameters for which determinations were made.

7587 (ORNL/TM–11883/R1) **PCB annual report for Oak Ridge National Laboratory EPA Identification Number - TN 1890090003, February 6, 1990–December 31, 1990.** Greer, J.K. Jr.; Foley, R.C. Oak Ridge National Lab., TN (United States). 15 Oct 1991. 139p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE92005306. Source: OSTI; NTIS; GPO Dep.

Oak Ridge National Laboratory prepares a report annually as mandated by the Toxic Substances Control Act (TSCA) that summarizes records required of owners/operators of facilities where PCBs are in use. This report provides information of PCB and PCB-contaminated equipment in use or removed from service and PCB wastes generated, stored, and shipped off-site for treatment and disposal during the time period February 6, 1990, through December 31, 1990, as required by the revised TSCA regulations described in the December 21, 1989, Federal Register (54 FR 52716).

7588 **Method of separating organic contaminants from fluid feedstreams with polyphosphazene membranes.** McCaffrey, R.R.; Cummings, D.G. To Dept. of Energy. 1990. Filed date 30 Apr 1990. USA Patent application 7-516,400. 12p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. Order Number DE92004607. Source: OSTI; NTIS; GPO Dep.

A method is provided for separating polar hydrocarbons from a fluid feedstream. The fluid feedstream is flowed across a first surface of a polyphosphazene semipermeable membrane. At least one polar hydrocarbon from the fluid feedstream permeates through the polyphosphazene semipermeable membrane to a second opposed surface of the semipermeable membrane. Then the permeated polar hydrocarbon is removed from the second opposed surface of the polyphosphazene semipermeable membrane. Outstanding and unexpected separation selectivities on the order of 10,000 were obtained for methylene chloride when a methylene chloride in water feedstream was flowed across the polyphosphazene semipermeable membrane in the invented method.

7589 (PNL–7927) **Ecological survey of M-Field, Edgewood Area Aberdeen Proving Ground, Maryland.** Downs, J.L.; Eberhardt, L.E.; Fitzner, R.E.; Rogers, L.E. Pacific Northwest Lab., Richland, WA (United States). Dec 1991. 60p. Sponsored by U.S. Department of Defense. DOE Contract AC06-76RL01830. Order Number DE92005174. Source: OSTI; NTIS; GPO Dep.

For U.S. Army Aberdeen Proving Ground, Maryland.

An ecological survey was conducted on M-Field, at the Edgewood Area, Aberdeen Proving Ground, Maryland. M-Field is used routinely to test army smokes and obscurants, including brass flakes, carbon fibers, and fog oils. The field has been used for testing purposes for the past 40 years, but little documented history is available. Under current environmental regulations, the test field must be assessed periodically to document the presence or potential use of the area by threatened and endangered species. The M-Field area is approximately 370 acres and is part of the US Army's Edgewood Area at Aberdeen Proving Ground in Harford County, Maryland. The grass-covered field is primarily lowlands with elevations from about 1.0 to 8 m above sea level, and several buildings and structures are present on the field. The ecological assessment of M-Field was conducted in three stages, beginning with a preliminary site visit in May to assess sampling requirements. Two field site visits were made June 3–7, and August 12–15, 1991, to identify the biota existing on the site. Data were gathered on vegetation, small mammals, invertebrates, birds, large mammals, amphibians, and reptiles.

7590 (PNL-SA–19779) **Expert reasoning within an object-oriented framework.** Bohn, S.J.; Pennock, K.A. Pacific Northwest Lab., Richland, WA (United States). Oct 1991. 7p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-9110269–1: Northcon 1991, Portland, OR (United States), 1-3 Oct 1991). Order Number DE92002142. Source: OSTI; NTIS; INIS; GPO Dep.

A large number of contaminated waste sites across the United States await site remediation efforts. These sites can be physically complex, composed of multiple, possibly interacting, contaminants distributed throughout one or more media. The Remedial Action Assessment System (RAAS) is being designed and developed to support decisions concerning the selection of remediation alternatives. The goal of this system is to broaden the consideration of remediation alternatives, while reducing the time and cost of making these considerations. The Remedial Action Assessment System was designed and constructed using object-oriented techniques. It is a hybrid system which uses a combination of quantitative and qualitative reasoning to consider and suggest remediation alternatives. the reasoning process that drives this application is centered around an object-oriented organization of remediation technology information. This paper briefly describes the waste remediation problem and then discusses the information structure and organization RAAS utilizes to address it. 4 refs., 4 figs.

7591 (POEF/ER/Sub–88/4523) **Well 6B remediation X-608B Well Field interim measures plan.** Portsmouth Gaseous Diffusion Plant, OH (United States); Geraghty and Miller, Inc., Dublin, OH (United States). Environmental Services. Jul 1991. 49p. Sponsored by U.S. DOE Environment Safety & Health. DOE Contract AC05-76OR00001. Order Number DE92002247. Source: OSTI; NTIS; GPO Dep.

On March 1, 1989, during routine maintenance on the Well 6B pump, approximately 264 milliliters of mercury was spilled into the water column of Well 6B, X-608 Wellfield. In addition, eight gallons of mineral oil were spilled and parts of the pump were lost down the well. This report discusses attempts to remediate the well and recommendations for future work. (JL)

7592 (PSI–103) **A physico-chemical characterisation technique for determining the pore-water chemistry in argillaceous rocks.** Baeyens, B. (Paul Scherrer Inst. (PSI), Villigen (Switzerland)); Bradbury, M.H. Paul Scherrer Inst. (PSI), Villigen (Switzerland). Sep 1991. 67p. Order Number DE92613488. Source: OSTI; NTIS (US Sales Only); INIS.

A prerequisite for carrying out credible sorption studies is the definition of an aqueous phase composition which is in equilibrium with the solid phase. Experimental methods and data analysis procedures are described which enable an equilibrium water composition to be produced for argillaceous rocks which is not dependent on liquid to solid (L:S) ratios. Since a Valanginian marl formation is under consideration by Nagra as a potential rock for the disposal of low and short-lived medium level radioactive waste in Switzerland, samples of this material were chosen for this investigation. Aqueous phase and nickel ethylenediamine extraction experiments were carried out at different L:S ratios under controlled atmosphere conditions (P_{CO_2}=10^{-2} bar, $O_2 \leq$ 5 ppm). The results from these tests and petrographical examinations were combined to define the system in terms of the physico-chemical characteristics of the clay mineral component (CEC and cation occupancies) and the identities of highly soluble and solubility limited phases in the marl. The geochemical code PHREEQE was used in conjunction with the Gapon equations to calculate the pore water composition. This work clearly showed that pore water chemistries obtained from aqueous extracts alone may lead to an arbitrary water chemistry in argillaceous rock systems, particularly with respect to ionic composition and ionic strength, which may have important consequences for radionuclide speciation and sorption studies. (author) 11 figs., 12 tabs., 25 refs.

7593 (PSI–105) **INTRAVAL test case 1b - modelling results.** Jakob, A. (Paul Scherrer Inst. (PSI), Villigen (Switzerland)); Hadermann, J. Paul Scherrer Inst. (PSI), Villigen (Switzerland). Jul 1991. 39p. Order Number DE92613460. Source: OSTI; NTIS (US Sales Only); INIS.

This report presents results obtained within Phase I of the INTRAVAL study. Six models are fitted to the results of four infiltration experiments with ^{233}U tracer on small samples of crystalline bore cores originating from deep drillings in Northern Switzerland. Four of these are dual porosity media models taking into account advection and dispersion in water conducting zones (either tubelike veins or planar fractures), matrix diffusion out of these into pores of the solid phase, and either non-linear or linear sorption of the tracer onto inner surfaces. The remaining two are equivalent porous media models (excluding matrix diffusion) including either non-linear sorption onto surfaces of a single fissure family or linear sorption onto surfaces of several different fissure families. The fits to the experimental data have been carried out by Marquardt-Levenberg procedure yielding error estimates of the parameters, correlation coefficients and also, as a measure for the goodness of the fits, the minimum values of the χ^2 merit function. The effects of different upstream boundary conditions are demonstrated and the penetration depth for matrix diffusion is discussed briefly for both alternative flow path scenarios. The calculations show that the dual porosity media models are significantly more appropriate to the experimental data than the single porosity media concepts. Moreover, it is matrix diffusion rather than the non-linearity of the sorption isotherm which is responsible for the tailing part of the breakthrough curves. The extracted parameter values for some models for both the linear and non-linear (Freundlich) sorption isotherms are consistent with the results of independent static batch sorption experiments. From the fits, it is generally not possible to discriminate between the two alternative flow path geometries. On the basis of the modelling results, some proposals for further experiments are presented. (author)

7594 (PSI–106) **A simple transport model for the Grimsel migration experiments.** Herzog, F. (Paul Scherrer Inst. (PSI), Villigen (Switzerland)). Paul Scherrer Inst. (PSI), Villigen (Switzerland). Sep 1991. 58p. Order Number DE92613461. Source: OSTI; NTIS (US Sales Only); INIS.

To understand the results of the field migration experiments of NAGRA at the Grimsel Test Site (Central Switzerland), it is necessary to develop models (hydraulic as well as transport models). In this paper a simple approach with streamtubes is described which allows to model the hydraulic situation for asymmetric dipole arrangements and transport along streamlines, including sorption and diffusion into fracture infill material. The model is confronted with two experiments, one with a nonsorbing tracer (uranine) and the other with sorbing (^{24}Na) and nonsorbing tracer material. The fit-by-eye parameter values are compatible with those from batch experiments. The sensitivity of breakthrough curves on the chosen parameters was checked with a parameter variation study. In the range of considered variations the breakthrough curves of nonsorbing tracers are not sensitive to matrix properties because saturation is achieved in all cases considered. For sorbing tracers the situation is more complicated as saturation may be achieved or not within the experimental timescale; due to this fact, it is emphasized, that step input experiments should be performed instead of pulse test experiments. (author) 17 figs., 4 tabs., 10 refs.

7595 (SAND–86-7006) **An evaluation of the seismicity of the Nevada Test Site and vicinity: Yucca Mountain Site Characterization Project.** Vortman, L.J. Sandia National Labs., Albuquerque, NM (United States). Dec 1991. 237p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC04-76DP00789. Order Number DE92004787. Source: OSTI; NTIS; INIS; GPO Dep.

Two USGS catalogs of earthquakes in the Southern Great Basin were edited to remove man-made seisms. Editing reduced 11,988 entries to 8,161. Known location of underground nuclear explosions provided an opportunity to assess location accuracy showing that accuracy differed according to the source of earthquake data. No evidence was found of explosions triggering earthquakes distant from the working points. Relationships are developed between earthquake magnitude and explosion yield for explosions at Pahute Mesa and Yucca Flat. Comparison of the number of underground nuclear explosions with the number of earthquakes of comparable magnitude shows the former exceeds the latter when magnitude is greater than four. Edited catalogs are recommended for hazard analysis relative to repository siting because unedited catalogs tend to greatly exaggerate seismicity of the region.

7596 (SAND–91-0430) **Modeling mineral dissolution and precipitation in dual-porosity systems.** Novak, C.F.; Gelbard, F. Sandia National Labs., Albuquerque, NM (United States). Oct 1991. 51p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9110152–2: 3. international conference on chemistry and migration behavior of actinides and fission products in the geosphere, Jerez de la Frontera (Spain), 21-25 Oct 1991). Order Number DE92003945. Source: OSTI; NTIS; INIS; GPO Dep.

A dual-porosity chemical transport model is applied to saturated fractured porous media. In this model, transport through fractures is advection-dominated while transport between the matrix and the fractures is diffusion-dominated. Recent studies in the literature indicate that conservative tracers and radionuclides in these systems will be retarded by matrix diffusion in the absence of chemical reactions. This study examines systems that include chemical reactions (e.g., dissolution/precipitation and aqueous complexation) and examines changes in retardation caused by precipitation.

7597 (SKB-TR–90-14) **Geomorphological and hydrogeological features of the Pocos de Caldas caldera and the Osamu Utsumi mine and Morro do Ferro analogue study sites, Brazil: Pocos de Caldas Report No. 5.** Holmes, D.C. (British Geological Survey, Keyworth, Nottingham (United Kingdom)); Pitty, A.E.; Noy, D.J. Brazil; SKB(SE); NAGRA(CH); DOE(GB); DOE(US) collaboration. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). 1990. 68p. Order Number DE92613489. Source: OSTI; NTIS (US Sales Only); INIS.

The Osamu Utsumi mine and Morro do Ferro study sites lie within the Pocos de Caldas plateau which is roughly circular in outline with a diameter of 35 km and an area of approximately 800 km^2. Its general altitude lies between 1300 and 1600 m. The plateau is the eroded form of a caldera which was initially intruded some 80 million years ago. Geomorphologically, both sites occupy watershed areas adjacent to small streams in the centre of the plateau. The climate of the area has a market wet season from November to April and is dry the rest of the year. The streams are ephemeral in their upper reaches, tending to dry up in the dry season as they are fed by a declining base flow. In the wet season they exhibit flash flood fed by high-intensity rainfall causing overland flow. The wet season also provides recharge to the groundwater. Natural slopes are steep and the original vegetation was thin forest cover which is now restricted to the valley bottoms; usable slopes have poor quality grass cover used for cattle grazing. The plateau is a stable feature and its surface has been eroding at an average rate of 12 m per million years over a period of 50 million years. The mine geology is dominantly volcanic to subvolcanic phonolites that have been hydrothermally altered. Fracturing of the rock is extensive. Downward diffusion of oxygen in groundwaters during deep weathering has produced a distinct redox zone seen as a colour change from green/grey to brown/yellow. Morro do Ferro has a more weathered version (laterite/clay) of the same geology penetrated by magnetite breccia dykes. Whilst the area surrounding Morro do Ferro remains untouched, that around the mine has been seriously disturbed by mining activity which has penetrated the water-table. The existing mine has modified groundwater flow patterns and disturbed the movement of oxidising and reducing waters. (au) (47 refs.).

7598 (SKB-TR–90-19) **Microbiological analysis at the Osamu Utsumi mine and Morro do Ferro analogue study sites, Pocos de Caldas, Brazil: Pcos de Caldas Report No. 10.** West, J.M. (British Geological Survey, Nottingham (United Kingdom)); Vialta, A.; McKinley, I.G. Brazil; SKB(SE); NAGRA(CH); DOE(GB); DOE(US) collaboration. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). 1990. 44p. Order Number DE92613462. Source: OSTI; NTIS (US Sales Only); INIS.

The Pocos de Caldas project is a wide-ranging natural analogue study focussed on a number of areas of concern in the performance assessment of the disposal of radioactive waste. Part of the work has involved characterising microbial populations and their influence in various processes. Core material and groundwaters have been sampled for microbiological content at various depths form boreholes at the Osamu Utsumi open pit uranium mine and Morro do Ferro Th/REE ore body. Microbes were found in all samples but numbers do not appear to be related to depth. Analyses of groundwaters gave higher numbers than with solid material and demonstrated the presence of sulphur cycle bacteria. These observations have been compared with predictions of a model used in performance assessment to calculate the maximum biomass/microbial activity based on constraints set by available nutrients and energy. The main conclusions of this analysis are: 1. Low microbial activities can be supported by the energy and nutrients supplied by alteration processes at or around the redox front. The maximum annual production of approximately equal to 0.01 - 0.1 g biomass (dry)/m^2 of redox front is in reasonable agreement with observed standing populations. 2. The presence of high concentrations of sulphate reducing bacteria around the redox front indicate a complex sulphur geochemistry which may be predominantly microbially catalysed and could explain the nodular form of pitchblende concretions and the presence of secondary pyrite. 3. There is little trace element mobilisation by organic byproducts and the main role of microbes in this system is to catalyse specific redox reactions. (au).

7599 (SKB-TR–90-22) **Near-field high-temperature transport: Evidence from the genesis of the Osamu Utsumi uranium mine, Pocos de Caldas alkaline complex, Brazil: Pocos de Caldas Report No. 13.** Cathles, L.M. (Cornell Univ., Dept. of Geological Sciences, Ithaca, New York (United States)); Shea, M.E. Brazil; SKB(SE); NAGRA(CH); DOE(GB); DOE(US) collaboration. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). 1990. 60p. Order Number DE92613490. Source: OSTI; NTIS (US Sales Only); INIS.

The chemical, isotopic and mineralogical alteration which occurred during primary uranium ore deposition at the breccia pipe-hosted Osamu Utsumi mine, Pocos de Caldas, Brazil, was studied as a natural analogue for near-field radionuclide migration. Chemical and isotopic alteration models were combined with finite difference models of the convective cooling of caldera intrusives. Application of the chemical models successfully used to interpret mineralization and alteration at the Osamu Utsumi mine to the hypothetical waste repository shows that even in a worst case scenario (waste emplaced in a permeable host rock with no measures taken to inhibit flow through the repository), the amount of hydrothermal alteration in the hypothetical repository will be about 0.1% of that in the breccia pipe at the Osamu Utsumi mine. Assuming no barriers to uranium mobility, uranium precipitation above the hypothetical repository would be 0.05 ppm (rather than 50 ppm), hydrothermal alteration 0.03 wt.% (rather than 30 wt.%), etc. The analysis indicates that mineralogical alteration is extremely sensitive to thermodynamic data. Prediction of mineralogical alteration (which may be necessary to predict the migration of radionuclides other than uranium, for example) probably cannot be based directly on even very carefully collected laboratory thermodynamic data. Mineralogical complexities of the system, as well as database uncertainties, will require calibration of the thermodynamic framework against mineralogical alteration observed in the laboratory or field by procedures briefly described. (au).

7600 (SKB-TR–91-22) **Aespoe hard rock laboratory. Evaluation and conceptual modelling based on the pre-investigations 1986-1990.** Wikberg, P. (ed.); Gustafson, G.; Rhen, I.; Stanfors, R. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Jun 1991. 225p. Order Number DE92613491. Source: OSTI; NTIS (US Sales Only); INIS.

The investigations have been grouped to several geometric scales under the disciplines of geology, geohydrology and groundwater chemistry, transport of solutes and mechanical stability. Geological mapping and geophysical measurements have been made both on a regional and on a site scale. On the site scale additional surface measurements, drilling of 35 percussion boreholes and 19 cored boreholes was made. The results of the geological investigations show that the Aespoe bedrock is a complex mixture between Smaaland granite, Aespoe diorite and fine grained granite. Hydraulic and chemical data was collected from existing well records within the Kalmar County. Hydraulic conductivity measurement and interference pumping tests were made in the core drilled holes and to some extent in the percussion holes. The hydraulic conductors are basically the fracture zones, but one of the most important is a NNW striking system of single fractures which is difficult to distinguish geologically. The chemical conditions of the groundwater and the fracture minerals form water bearing sections of the core drilled holes have been examined. Water samples were collected from percussion boreholes. The groundwater can be divided into three categories. Fresh water down to approximately 50 m depth. Mixed fresh and seawater 50-100 m, present and/or relict seawater 100-500 m and old (relict) seawater below a depth of 500 m. An important task in the evaluations is to set up 'conceptual models'. These models are the basis for calculation of the ambient groundwater situation and the way in which the hydrological regime will change during the excavation of the laboratory. In order to allow for different levels of detail the conceptual models are established on different scales. The geometrical scales chosen are 500 m, 50 m and 5 m. (au).

7601 (SKB-TR--91-24) **Hydrogeological conditions in the Finnsjoen area. Compilation of data and conceptual model.** Andersson, J.E. (Swedish Geological Co., Uppsala (Sweden)); Nordqvist, R.; Nyberg, G.; Smellie, J.; Tiren, S. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Feb 1991. 205p. Order Number DE92613492. Source: OSTI; NTIS (US Sales Only); INIS.

In the present report all available data gathered from the Finnsjoen area of potential use for numerical modelling are compiled and discussed. The data have been collected during different phases during the period 1977-1989. This inevitably means that the quality of the measured and interpreted data varies in accordance with the continuous developments of improved equipments and interpretation techniques. The present report is an updated version of the SKB progress report 89-24 with the same title and authors, see introduction. (au).

7602 (SKB-TR--91-25) **The role of the disturbed rock zone in radioactive waste repository safety and performance assessment. A topical discussion and international overview.** Winberg, A. (Conterra AB, Goeteborg (Sweden)). Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Jun 1991. 77p. Order Number DE92613493. Source: OSTI; NTIS (US Sales Only); INIS.

A discussion was presented of the role and relative importance of the disturbed rock zone (DRZ) around the underground openings of a repository for nuclear waste in crystalline rock. The term disturbed rock zone was defined and possible criteria to be sued to distinguish if from undisturbed rock was suggested. The processes decisive for the hydraulic characteristics of the DRZ were discussed. With regard to the integral hydraulic characteristics of the DRZ, the effects of the excavation methodology, stress redistribution, thermal changes, chemical changes and backfill were discussed. A review of in-situ observations of the DRZ was provided. Model analysis where the DRZ has been explicitly or implicitly represented, either from a phenomenological and performance assessment aspect were reviewed. The implications of the disturbed rock zone for the safe performance of a nuclear waste repository were discussed. Conceptual models for the geometry of the DRZ and hydraulic conductivity distribution in the DRZ were suggested. (au) (82 refs.).

7603 (STRIPA-IR--91-02) **Site characterization and validation - monitoring of head in the Stripa mine during 1989.** Carlsten, S. (Swedish Geological Co., Uppsala (Sweden)); Nyberg, G.; Tammela, P.T.; Olsson, O.; Sehlstedt, M. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Nov 1990. 204p. Order Number DE92613494. Source: OSTI; NTIS (US Sales Only); INIS.

The groundwater head has been monitored in some 50 borehole sections surrounding the site which is investigated as a part of the site characterization and validation project. This report contains basic data on the head monitoring system and graphical presentation of the results obtained during 1989. (au).

7604 (STRIPA-IR--91-12) **Site characterization and validation - monitoring of head in the Stripa mine during 1990.** Carlsten, S. (Swedish Geological Co., Uppsala (Sweden)); Nyberg, G.; Tammela, P.T.; Olsson, Olle. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Apr 1991. 219p. Order Number DE92613495. Source: OSTI; NTIS (US Sales Only); INIS.

The groundwater head has been monitored in 45 borehole sections surrounding the site which is investigated as a part of the site characterization and validation project. This report contains basic data on the head monitoring system and graphical presentation of the results obtained during 1990. (au).

7605 (STRIPA-IR--91-15) **Inflow measurements on the D-holes at the Stripa mine.** Danielson, J. (SGAB, Uppsala (Sweden)); Ekman, L.; Joensson, S. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Jun 1991. 135p. Order Number DE92613496. Source: OSTI; NTIS (US Sales Only); INIS.

Flow measurements in 0.5 m-sections in the D-boreholes at Stripa were performed by Swedish Geological Company during February to April 1991. The purpose of the measurements was to determine in detail the inflow to an array of boreholes through an undisturbed volume of fractured granite. A lower measurement limit of $1x10^{-4}$ l/min was stipulated for the measurements in 0.5 m-sections. However, in practice the inflow measurements were initially performed in 4.5 m-sections, which made it possible to reach an even lower measurement limit. Furthermore, by this method the tests were speeded up, because in all 4.5 m-sections where the flow fell below $1x10^{-4}$ l/min, no detailed measurements in 0.5 m-sections were necessary. The accuracy of the measurements was 5% for flow in the interval greater than or equal to $1x10^{-3}$ l/min and 100% for flow below that value. The boreholes D5 and D6 have relatively high inflows to the entire boreholes, about $450x10^{-3}$ l/min respectively $90x10^{-3}$ l/min. The inflow values to the remaining boreholes are much lower: between about $3x10^{-3}$ and $13x10^{-3}$ l/min. The flow distribution along the boreholes is rather similar in boreholes D1, D3 and D6, with flow maxima at about 80-90 m borehole length. At this level peaks are found also in boreholes D2, D4 and D5, but in the latter boreholes increased flow values occur also closer to the borehole outlets. Indications of hydraulic connections between different boreholes were observed. Inflation of the packers at certain locations in one borehole caused in some cases flow changes in neighbouring boreholes. (au).

7606 (STRIPA-TR--91-07) **Site characterization and validation - results from seismic crosshole and reflection measurements - Stage 3.** Cosma, C. (Vibrometric Oy, Helsinki (Finland)); Heikkinen, P.; Keskinen, J.; Korhonen, R. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Jan 1991. 66p. Order Number DE92613497. Source: OSTI; NTIS (US Sales Only); INIS.

The purpose of the site characterization and validation (SCV) project is to predict groundwater flow and nuclide transport in a previously unexplored volume of the Stripa granite. The project comprises five stages. This report concerns the borehole seismic investigations carried out during stage 3. The objective has been to review the localization and characterization of fractured and altered rock zones performed in stage 1. The seismic acquisition apparatus and the data processing techniques have been the subject of major changes with respect to stage 1 and their features are outlined. The use of boreholes is important, as surveys performed from drifts and surface permit only a limited probing angle of the site volume. The approach consists of applying in parallel two methods: two-dimensional crosshole tomography and a new three-dimensional reflection imaging technique. The reflection method detects changes in acoustic impedance, which is an accurate way of finding the boundaries of rock features. The tomographic method maps variation of the rock properties, like wave velocity and attenuation. The fractured zones from the SCV site produce a faint seismic response. Extensive processing was used to achieve a unambiguous interpretation of the reflection data. The tomographic analysis of velocities reveals and extremely flat variation of 1-3%. (au).

7607 (STRIPA-TR--91-10) **A comparison of predictions and measurements for the Stripa simulated drift experiment.** Hodgkinson, D. (Intera Sciences, Henley-on-Thames (United Kingdom)). Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Feb 1991. 59p. Order Number DE92613498. Source: OSTI; NTIS (US Sales Only); INIS.

This paper presents a comparison of measurements and predictions for the simulated drift experiment based on groundwater flow to the D-holes at the SCV site. The comparison was carried out on behalf of the Stripa task force on fracture flow modelling, as a learning exercise for the validation exercise to be based on flow to the validation drift. The paper summarises the characterisation data and their preliminary interpretation, and reviews the fracture flow modelling predictions made by teams from AEA Harwell, Golder Associates and Lawrence Berkeley Laboratory. The predictions are compared with each other and with the D-hole inflow measurements, and this experience is used to provide detailed feedback to future experimental and modelling work. (35 refs.).

7608 (STRIPA-TR-91-11) **The Stripa project. Annual report 1990.** Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Jul 1991. 164p. Order Number DE92613499. Source: OSTI; NTIS (US Sales Only); INIS.

The Stripa project is an international project being performed under the sponsorship of the OECD Nuclear Energy Agency (NEA). The project concerns research related to the disposal of highly radioactive waste in crystalline rock. The research and development division of the Swedish Nuclear Fuel and Waste Management Co. (SKB) has been entrusted with the management of the project, under the direction of representatives from each participating country. The aim of this report is to inform the OECD Nuclear Energy Agency and the participants in the project about the general progress of work during 1990.

7609 (STRIPA-TR-91-14) **Tracer transport in fractures: analysis of field data based on a variable - aperture channel model.** Tsang, C.F. (LBL, Univ. of California, CA (United States)); Tsang, Y.W.; Hale, F.V. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Jun 1991. 63p. Order Number DE92613500. Source: OSTI; NTIS (US Sales Only); INIS.

A variable-aperture channel model is used as the basis to interpret data from a three-year tracer transport experiment in fractured rocks. The data come from the so-called Stripa-3D experiment performed by Neretnieks and coworkers. Within the framework of the variable-aperture channel conceptual model, tracers are envisioned as travelling along a number of variable-aperture flow channels, whose properties are related to the mean b^- and standard deviation σ_b of the fracture aperture distribution. Two methods are developed to address the presence of strong time variation of the tracer injection flow rate in this experiment. The first approximates the early part of the injection history by an exponential decay function and is applicable to the early time tracer breakthrough data. The second is a deconvolution method involving the use of Toeplitz matrices and is applicable over the complete period of variable injection of the tracers. Both methods give consistent results. These results include not only estimates of b and σ, but also ranges of Peclet numbers, dispersivity and an estimate of the number of channels involved in the tracer transport. An interesting and surprising observation is that the data indicate that the Peclet number increases with the mean travel time: i.e., dispersivity decreasing with mean travel time. This trend is consistent with calculated results of tracer transport in multiple variable-aperture fractures in series. The meaning of this trend is discussed in terms of the strong heterogeneity of the flow system. (au) (22 refs.).

7610 (UCRL-ID-107469) **Apparatus for California Waste Extraction Test.** Harrar, J.E. Lawrence Livermore National Lab., CA (United States). 10 Jun 1991. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE92003048. Source: OSTI; NTIS; GPO Dep.

An apparatus has been designed that is suitable for performing the extraction test mandated by the state of California for the characterization of solid and semisolid hazardous waste. The apparatus enables mixing of the waste with the extraction fluid in the absence of air, and all parts contacting the waste mixture are either fluoropolymer or glass.

7611 (UCRL-JC-107037) **Effect of Lamp-coating mineral deposits on UV-oxidation of ground water.** Camp, D.W. Lawrence Livermore National Lab., CA (United States). Nov 1991. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-920221-1: 2. national research and development conference on the control of hazardous materials, San Francisco, CA (United States), 4-6 Feb 1992). Order Number DE92003968. Source: OSTI; NTIS; GPO Dep.

Ultraviolet (UV)-oxidation is a rapidly emerging technology for treating contaminated ground water in pump and treat remediation schemes. A UV-oxidation system adds hydrogen peroxide (and/or ozone) to the water and shines intense UV light through it to produce hydroxide radicals which oxidize the UV-destabilized organics. A common and costly problem in field applications of this technology is the buildup of UV-absorbing deposits on the quartz tubes that shield the lamps. In a 50-gallons/minute (gpm) treatment unit at Lawrence Livermore National Laboratory (LLNL), we observed dramatic deterioration of performance associated with the buildup of an iron-rich coating in 1 to 2 weeks of operation with very low-iron water. To investigate the connection between deposit growth and diminished performance, we measured the transmissivity spectra of quartz tubes removed from the reactor, the deposit thickness and composition, and the reactor destruction efficiency. This paper reports primarily on the effect of deposit growth on UV absorption, and the effect of this on reactor performance. It touches secondarily on deposit chemistry and options for managing the deposit problem.

7612 (UCRL-JC-108155) **Electrical resistance tomography to monitor vadose water movement.** Ramirez, A. (Lawrence Livermore National Lab., CA (United States)); Daily, W.; LaBrecque, D. Lawrence Livermore National Lab., CA (United States). Sep 1991. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-910981-44: Environmental remediation '91 conference, Pasco, WA (United States), 8-11 Sep 1991). Order Number DE92003064. Source: OSTI; NTIS; GPO Dep.

We report results of one test in which Electrical Resistance Tomography (ERT) was used to map the changes in electrical resistivity in the vadose zone as a function of time while water infiltration occurred. The ERT images were used to infer shape and movement of the infiltration plume in the unsaturated soil. We supplied a continuous water source at a point about 10 feet below the surface (at the end of a shallow screened hole) for only a short time – 2.5 hours. This pulsed source introduced a "slug" of water whose infiltration was followed to about 60 foot depth during a 23 hour period. The ERT images show resistivity decreases as the water content of the vadose zone increased while water was added to the soil; the resistivity of the soil later increased after the supply of water was cut-off and the induced soil moisture began to subside.

7613 (WHC-EP-0489) **Hanford Site surface soil radioactive contamination control plan for fiscal year 1992.** Winship, R.A.; Hughes, M.C. Westinghouse Hanford Co., Richland, WA (United States). Nov 1991. 113p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE92004542. Source: OSTI; NTIS; INIS; GPO Dep.

The Surplus Facilities and Resource Conservation and Recovery Act of 1976 (RCRA) closures program is responsible to the US Department of Energy Field Office, Richland, for the safe and cost-effective surveillance, maintenance, and decommissioning of surplus facilities and RCRA closures at the Hanford Site. This program is also responsible for the Radiation Area Remedial Action (RARA) work that includes the surveillance, maintenance, decontamination, and/or interim stabilization of inactive burial grounds, cribs, ponds, trenches, and unplanned release sites. This plan addresses only the RARA activity requirements for managing and controlling the contaminated surface soil areas associated with these inactive sites until they are remediated as part of the Hanford Site environmental restoration process. All known RARA and non-RARA contaminated surface soil areas are listed in this document so that a complete list of the sites requiring remediation is in one document. Specific organizational responsibility for management and control of these sites is shown in Appendix A.

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Refer also to citation(s) 6248, 6306, 6307, 6409, 6410, 6411, 6413, 6453, 6455, 6456, 6458, 6460, 6508, 6509, 6510, 6511, 6512, 7054, 7516, 7546, 7548, 7557, 7558, 7560, 7576, 7577, 7586, 7590, 7597, 7803, 7818, 8409, 8447

7614 (CONF-911049–5) **The separation of particulates from supercritical water oxidation processes.** Dell'Orco, P.C.; Li, L.; Gloyna, E.F. Texas Univ., Austin, TX (United States). [1991]. 18p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC05-76OR00033. From 7. symposium on separation science and technology for energy applications; Knoxville, TN (United States); 20-24 Oct 1991. Order Number DE92004763. Source: OSTI; NTIS; GPO Dep.

Small hydrocyclones with batch underflow receivers were assessed for their ability to separate micron-sized particulates from near-critical water solutions. Such particulates are expected from the effluent of a supercritical water oxidation reactor. The separation of micron-sized quartz silica, zirconia, and titania particles was investigated. A model was developed for the prediction of gross removal efficiencies as a function of a Stokes' number. Particle size distributions provided grade efficiencies for all experiments, and from these data, cut sizes were determined. Gross efficiencies up to 99% were observed for zirconia; cut sizes (d_{90} and d_{95}) near one micron were measured. 19 refs., 5 figs.

7615 (DOE/OR/21548–224) **Quarry detection monitoring wells completion report WP-166: Weldon Spring Site Remedial Action Project, Weldon Spring, Missouri.** MK-Ferguson Co., St. Charles, MO (United States); Jacobs Engineering Group, Inc., St. Charles, MO (United States). Sep 1991. 51p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-86OR21548. Order Number DE92001946. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this report is to document the activities undertaken during implementation of Work Package 166, Quarry Detection Monitoring Wells, for the Weldon Spring Site Remedial action project, Weldon Spring, Missouri. The subcontract specifications should be consulted for specific details regarding this work effort. Analytical parameters for soil samples collected for all but one borehole were analyzed for uranium, thorium, cyanide, nitroaromatics, and all Hazardous Substance List parameters including volatiles, semivolatiles, pesticides, polychlorinated biphenyls (PCBs) and metals. No soil samples were collected at other borehole as per specifications. With Z exceptions, uranium results for all boreholes sampled were at background levels. Nitroaromatics and cyanide were not detected in any of the samples collected. Volatile and semivolatile organics were not detected in the soil samples collected from the boreholes, with the exception of common lab contaminants such as methylene chloride, toluene, acetone, and pathalates. All metals results were either within their natural background ranges or below the detection limit of the instrument. PCB's were not detected within any of the boreholes. Pesticides detected (aldrin and methoxychlor) at one borehole near the surface may be attributed to previous spraying of pesticides on the highway right-of-way. In conclusion, the analytical results show that only uranium was detected in significant quantities; all other results were below the detection limit, very near the detection limit, or within natural background ranges. 1 fig.

7616 (DOE/RL–91-44) **Description of codes and models to be used in risk assessment.** USDOE Richland Operations Office, WA (United States). Sep 1991. 24p. Sponsored by U.S. DOE Environment Safety & Health. Order Number DE92002916. Source: OSTI; NTIS; INIS; GPO Dep.

Human health and environmental risk assessments will be performed as part of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) remedial investigation/feasibility study (RI/FS) activities at the Hanford Site. Analytical and computer encoded numerical models are commonly used during both the remedial investigation (RI) and feasibility study (FS) to predict or estimate the concentration of contaminants at the point of exposure to humans and/or the environment. This document has been prepared to identify the computer codes that will be used in support of RI/FS human health and environmental risk assessments at the Hanford Site. In addition to the CERCLA RI/FS process, it is recommended that these computer codes be used when fate and transport analyses is required for other activities. Additional computer codes may be used for other purposes (e.g., design of tracer tests, location of observation wells, etc.). This document provides guidance for unit managers in charge of RI/FS activities. Use of the same computer codes for all analytical activities at the Hanford Site will promote consistency, reduce the effort required to develop, validate, and implement models to simulate Hanford Site conditions, and expedite regulatory review. The discussion provides a description of how models will likely be developed and utilized at the Hanford Site. It is intended to summarize previous environmental-related modeling at the Hanford Site and provide background for future model development. The modeling capabilities that are desirable for the Hanford Site and the codes that were evaluated. The recommendations include the codes proposed to support future risk assessment modeling at the Hanford Site, and provides the rational for the codes selected. 27 refs., 3 figs., 1 tab.

7617 (INIS-BR–2882) **Nuclear techniques use on pollution study in Jacarepagua Lagoon.** Mendes, C.L.O. de; Delgado, J.U. Instituto de Radioprotecao e Dosimetria (IRD), Rio de Janeiro, RJ (Brazil). 1989 3p. (In Portuguese). (CONF-9109325–: 2. Cycle of conferences and debates about Jacrepagua Lagunes, Rio de Janeiro (Brazil), 16-20 Sep 1991). Order Number DE92614883. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. WATER POLLUTION/neutron activation analysis

7618 (INIS-mf–13025 vp.) **Speculative subtracer chemistry of plutonium in environmental conditions (Preprint no. IT-22).** Guillaumont, Robert (Institute of Nuclear Physcis, Orsay (France). Radiochemistry Group). Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. Feb 1991. 685p. (CONF-9102132–: International symposium on radiochemistry and radiation chemistry - plutonium 50, Bombay (India), 4-7 Feb 1991). In *International symposium on radiochemistry and radiation chemistry (Plutonium - 50 years) (held at Bombay during February 4-7, 1991): Preprints volume.* Order Number DE92001334. Source: OSTI; NTIS (US Sales Only); INIS.

The aim of this paper is to discuss the behaviour of Pu in environmental-like situations. This is an illustration of the concepts of subtracer chemistry because most of the nuclear and chemical properties of Pu isotopes fit well the criterias required for observable reactions. The predicted behaviour of Pu quantities, down to few atoms, based on the situation known for usual concentrations is discussed. First, a short survey of Pu concentrations in environmental situations is given. Then the most probable equilibria of Pu species to be achieved, now or in a far future are selected. Finally how these equilibria are modified in the case of few Pu atoms is examined. (author). 50 refs., 4 tabs., 6 figs.

7619 (INIS-mf–13087) **Summary report on the radiation environment of the Danube river within 1977-1980 period.** ORB. Obespechenie Radiatsionnoj Bezopasnosti. Petkov, T.; Novakova, E.; Kerteva, A.; Mireva, Z.; Bodulin, V.; Borisova, Yu.; Stepanova, V.D.; Pavlovskij, O.A. Sovet Ehkonomicheskoj Vzaimopomoshchi, Moscow (USSR). Postoyannaya Komissiya po Ispol'zovaniyu Atomnoj Ehnergii v Mirnykh Tselyakh. 1983 39p. (In Russian). Order Number DE92614884. Source: OSTI; NTIS (US Sales Only); INIS. 7 refs.; 18 tabs.

The radiation environment of the Danube river has been studied from Bratislava city down to river mouth that is within the distance of 1869 km. Systematic measurements were carried out at 22 points in the territories of the USSR, Roumania, Bulgaria, Hungary and Czechoslovakia. Samples of water, sediments and aquatic organisms were used to determine such radionuclides as natural uranium, radium-226, potassium-40, tritium, strontium-90, cesium-137. In general the radiation environment of the Danube river can be considered as a function of the natural radionuclides presence and artificial radionuclides global fallout. No specific radionuclides from other sources were observed. Thus a conclusion can be drawn that the presence of operating Nuclear Power Plants in the Danube vally has no negative effects on its radiation environment. Measurements data of radionuclide concentrations are given. 7 refs.; 18 tabs.

7620 (INIS-mf–13088) **Investigations of Baltic See radioactivity within 1976-1980.** ORB. Obespechenie Radiatsionnoj Bezopasnosti. Weiss, D.; Lyonnig, M.; Tille, J.; Gzhibovska, D.; Tomchak, Ya.; Gedeonov, L.I.; Gusev, D.I.; Ivanova, L.M.; Pavlovskij, O.A.; Stepanova, V.D. Sovet Ehkonomicheskoj Vzaimopomoshchi, Moscow (USSR). Postoyannaya Komissiya po Ispol'zovaniyu Atomnoj Ehnergii v Mirnykh Tselyakh. 1983 87p. (In Russian). Order Number DE92614885. Source: OSTI; NTIS (US Sales Only); INIS.

The report presents summary of data on the Baltic Sea radioactive contamination obtained in DDR, PPR and the USSR within 1976-1980. The seawater, sediments and aquatic plants and animals were investigated. The distribution of strontium-90 and cesium-137 isotopes is given both for the open sea and its gulfs. Tendency towards strontium-90 concentration decrease is noted though cesium-137 concentration rise was observed in 1980 due to radioactive and polluted water ingress from the Northern Sea. In a number of points, except western regions in the vicinity of the Northern Sea, uniform distributions of strontium-90 and cesium-137 concentations versus depth were established. The radionuclide contents in water, sediments and aquatic organisms of Greifswald and Finland gulfs where Nuclear Power Plants are located on the seashore were found to be the same as in the open sea. The dependence of strontium-90 and especially cesium-137 sorption on the sediments composition has been noticed. In 1980 DDR presented data on tritium content in both near-surface and deep waters. Poland has carried out the first investigations of plutonium-239 and 240 content in the sediments. The dynamic behaviour of strontium-90 and cesium-137 concentrations in the Baltic Sea water within 1959-1980 has been reviewed. Data on strontium-90 and cesium-137 content in fishes and plants are given. On this basis the dose commitmments for population were estimated. 19 refs.; 27 tabs.; 6 figs.

7621 (INIS-mf–13089) **Summary report on the Danube river radiation environment within 1981-1985.** ORB. Obespechenie Radiatsionnoj Bezopasnosti. Sovet Ehkonomicheskoj Vzaimopomoshchi, Moscow (USSR). Postoyannaya Komissiya po Ispol'zovaniyu Atomnoj Ehnergii v Mirnykh Tselyakh. 1987 31p. (In Russian). Order Number DE92614886. Source: OSTI; NTIS (US Sales Only); INIS.

Radiation environment of the Danube river from Bratislava city (Czechoslovakia) down to the river mouth was investigated systematically within 1981 to 1985. This report summarizes the data obtained in CMEA member-countries who participated in this work: Czechoslovakia, Hungary, Roumania, Bulgaria and the USSR. The samples for radioactivity measurements were taken at 21 points over 1869 km distance. Mainly the samples of the river water and sediments have been studied with measuring total alpha- and beta-activity and identifying such nuclides as natural uranium, radium-226, potassium-40, tritium, strontium-90 and cesium-137. The measurements data are presented. In general the radiation environment of the Danube river is considered as favorable, it does not differ from the state observed in previous time periods. No contribution by Nuclear Power Plants to the Danube river radioactivity has been revealed. The evaluated dose commitments for critical groups of population are four orders of magnitude lower than those from the natural radiation sources. 20 tabs.

7622 (INIS-mf–13090) **Baltic Sea radioactivity studies within 1981-1985.** ORB. Obespechenie Radiatsionnoj Bezopasnosti. Sovet Ehkonomicheskoj Vzaimopomoshchi, Moscow (USSR). Postoyannaya Komissiya po Ispol'zovaniyu Atomnoj Ehnergii v Mirnykh Tselyakh. 1987 97p. (In Russian). Order Number DE92614887. Source: OSTI; NTIS (US Sales Only); INIS.

The report summarizes the results of the Baltic Sea radioactivity studies within 1981-1985 carried out by CMEA member-countries: DDR, PPR and the USSR. These studies were related to the impact from a number of Nuclear Power Plants located at the Baltic seashore. The distribution of strontium-90, cesium-137 and tritium concentrations across the Baltic Sea aquatory has been studied both in near-surface and deep water layers. The statistical analysis of the obtained data has revealed their normal distribution. The radionuclide contents were measured both in edible and non-edible parts of fishes and dose commitments due to internal irradiation related to the fish eating calculated for critical group as well as for general population. Both the found volumetric activities and evaluated dose commitments are 3-4 orders of magnitude lower than the permissible levels established by the regulations used in DDR, PPR and the USSR. The summarized statistical data and calculation results are presented in tables and graphics. Wide experience in the sea radioactivity studies has been acquired. 12 refs.; 22 tabs.; 15 figs.

7623 (KAERI/RR–962/90) **Environmental isotope aided studies on water resources in the region of Cheju (VII).** Ahn, Jong Sung (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Kim, Jhin Wung; Kim, Sun Joon; Kim, Jin Se; Yoo, Jang Keol; Song, Sung Joon. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1991. 66p. (In Korean). Order Number DE92614889. Source: OSTI; NTIS (US Sales Only); INIS.

Cheju island formed by Quarternary volcanism has highly permeable hydrogeological environment. To meet the increasing demand of water in the island, many groundwater wells have been developed. The environmental isotopes (oxygen-18, deuterium, tritium) study and chemical analysis on water samples from the eastern part of the island were carried out to ascertain whether groundwater in the eastern part of the island was contaminated by sea water. The result of tritium analysis indicated fast infiltration of meteoric water into underground and rapid mixing process between rain water and groundwater. The results of oxygen-18 and deuterium analysis demonstrated that most of the wells in the eastern part of the island were influenced by sea water intrusion. Based on chemical analysis of water samples most of groundwater in study area were classified into Na-Cl type and showed high chloride/bicarbonate ratios. Sea water intrusion in the northeastern part of the island has proceeded to inward island at least 3 km from the coastal line, and in the southeastern part about 700 m. (Author).

7624 (MAFF-AEMR–19) **Radioactivity in surface and coastal waters of the British Isles, 1987.** Hunt, G.J. Ministry of Agriculture, Fisheries and Food, Lowestoft (United Kingdom). Directorate of Fisheries Research. 1988. 67p. Order Number DE92614891. Source: OSTI; NTIS (US Sales Only); INIS.

This report presents the results of the environmental monitoring programme carried out during 1987 by staff of the Directorate of Fisheries Research, Lowestoft. The monitoring programme supports the Ministry's functions under the Radioactive Substances Act, 1960 (Great Britain-Parliament, 1960). The programme is set up to verify the satisfactory control of liquid radioactive waste discharges to the aquatic environment, and to ensure that the resulting public radiation exposure is within nationally-accepted limits. The monitoring is independent of similar programmes carried out by nuclear site operators as a condition of their authorisations to discharge radioactive wastes. This report also includes results of monitoring carried out on behalf of departments of the Scottish Office, the Welsh Office, the Department of the Environment for Northern Ireland [DOE (NI)] and the Channel Islands States. Where appropriate, the information presented is supplemented by results from our extensive programme of research into the behaviour of radioactivity in the aquatic environment. (author).

7625 (NEI-SE–90) **A costal dispersion model.** Rahm, L.; Nyberg, L.; Gidhagen, L. Sveriges Meteorologiska och Hydrologiska Inst., Norrkoeping (Sweden). [1990]. 10p. (In Swedish). Order Number DE92613509. Source: OSTI; NTIS (US Sales Only); INIS.

A dispersion model to be used off costal waters has been developed. The model has been applied to describe the migration of radionuclides in the Baltic sea. A summary of the results is presented here. (K.A.E).

7626 (ORNL/ER–46) **Final report on the waste area grouping perimeter groundwater quality monitoring well installation program at Oak Ridge National Laboratory, Oak Ridge, Tennessee.** Greene, J.A. Oak Ridge National Lab., TN (United States). Jun 1991. 72p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC05-84OR21400. Order Number DE92002379. Source: OSTI; NTIS; INIS; GPO Dep.

A groundwater quality monitoring well installation program was conducted at Oak Ridge National Laboratory (ORNL) to meet the requirements of environmental regulations, including the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). A total of 173 wells were installed and developed at 11 different waste area groupings (WAGs) between June 1986 and November 1990. A location map of the wells is included.

7627 (ORNL/M-1809) **Functional requirements for Waste Area Grouping 6 Monitoring Station 3 upgrade.** Fiuzat, A.A. (Environmental Consulting Engineers, Inc., Knoxville, TN (United States)). Oak Ridge National Lab., TN (United States); Environmental Consulting Engineers, Inc., Knoxville, TN (United States). Jun 1991. 39p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC05-84OR21400. (X-OE-552). Order Number DE92003550. Source: OSTI; NTIS; INIS; GPO Dep.

The surface Waste Area Grouping (WAG)6 at ORNL may undergo many changes in the future as part of the closure activities. Changes in surface characteristics will cause changes in runoff characteristics of the MS 3 watershed. Appropriate assumptions are to be made in this project regarding the future surface conditions of the watershed. The extent to which the assumed surface conditions will affect the project objectives (defined in Section 1.0) is to be identified. The purpose of this FRD is to establish performance requirements for MS 3 consisting of the following: (1) The expected range of discharges passing through the station and the required accuracy levels for discharge measurements. (2) The equipment required to measure the expected discharges at the required accuracy levels. (3) The sampling requirements for monitoring water quality. (4) The hydraulic requirements for the discharge conveyance structure to be located under the IWMF access road. (5) The design loads to be used for the bridge over the IWMF access road. 12 refs., 5 figs.

7628 (ORNL/TM-11886) **Preliminary site characterization summary and engineering evaluation/cost analysis for Site 2, New Fuel Farm, Naval Air Station Fallon, Fallon, Nevada.** Cronk, T.A. (Oak Ridge National Lab., TN (United States)); Smuin, D.R.; Schlosser, R.M. Oak Ridge National Lab., TN (United States). Sep 1991. 81p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE92004598. Source: OSTI; NTIS; GPO Dep.

This report addresses subsurface contamination associated with Site 2, the New Fuel Farm at Naval Air Station Fallon (NAS Fallon), Nevada and is an integral part of Phase 2 of the Installation Restoration Program (IR Program) currently underway at the facility. This report: (1) reviews and assesses environmental information characterizing Site 2; (2) determine if site-characterization information is sufficient to design and evaluate removal actions; and, (3) investigates, develops, and describes any removal actions deemed feasible. Previous environmental investigations at Site 2 indicate the presence of floating product (primarily JP-5, jet fuel) on the water table underlying the facility. While the extent of floating-produce plumes has been characterized, the degree of associated soil and groundwater contamination remains uncertain. A comprehensive characterization of soil and groundwater contamination will be completed as the Remedial Investigation/Feasibility Study progresses. Corrective actions are recommended at this time to remove free-phase floating product. Implementing these removal actions will also provide additional information which will be used to direct further investigations of the extent, mobility, and potential environmental threat from soil and groundwater contaminants at this side.

7629 (PNL-7836) **External quality control in ground-water sampling and analysis at the Hanford Site.** Hall, S.H.; Juracich, S.P. Pacific Northwest Lab., Richland, WA (United States). Nov 1991. 44p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-76RL01830. Order Number DE92004452. Source: OSTI; NTIS; INIS; GPO Dep.

At the US Department of Energy's Hanford Site, external Quality Control (QC) for ground-water monitoring is extensive and has included routine submittal of intra- and interlaboratory duplicate samples, blind samples, and several kinds of blank samples. Examination of the resulting QC data for nine of the constituents found in ground water at the Hanford Site shows that the quality of analysis has generally been within the expectations of precision and accuracy that have been established by the US Environmental Protection Agency (EPA). The constituents subjected to review were nitrate, chromium, sodium, fluoride, carbon tetrachloride, tritium, ammonium, trichloroethylene, and cyanide. Of these, the fluoride measurements were notable exceptions and were poor by EPA standards. The review has shown that interlaboratory analysis of duplicate samples yields the most useful QC data for evaluating laboratory performance in determining commonly encountered constituents. For rarely encountered constituents, interlaboratory comparisons may be augmented with blind samples (synthetic samples of known composition). Intralaboratory comparisons, blanks, and spikes should be generally restricted to studies of suspected or known sample contamination and to studies of the adequacy of sampling and analytical procedures.

7630 (PNL-7869-HEDR) **References for radioactive releases to the Columbia River from Hanford Operations, 1944-1957: Letter report: Hanford Environmental Dose Reconstruction Project.** Hall, R.B. Pacific Northwest Lab., Richland, WA (United States). Nov 1991. 27p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-76RL01830. Order Number DE92003984. Source: OSTI; NTIS; INIS; GPO Dep.

A search was made for published documents related to discharges of radioactive material from Hanford Site facilities to the Columbia River from 1944-1957. The purpose was to list documents that contain data that might be useful in developing a source term for waterborne releases. Source term development work will take place in FY 1992, and FY 1993. This tabulation of published summaries of release data shows the type of measurements that were being made from 1944-1957 and the magnitude of discharges to the Columbia River. In the early years, very little data were collected that related to specific radionuclides. However, most of the key radionuclides were known to be present in effluents from occasional specific radionuclide analyses.

7631 (PNL-7876) **Episodic response project: Wet deposition at watersheds in three regions of the eastern United States.** Barchet, W.R. Pacific Northwest Lab., Richland, WA (United States). Nov 1991. 200p. Sponsored by Environmental Protection Agency. DOE Contract AC06-76RL01830. Order Number DE92004709. Source: OSTI; NTIS; INIS; GPO Dep.

During the period from August 1988 to June 1990, wet-only sampling of precipitation was carried out at three Episodic Response Project sites and at one supplemental site. The three watershed sites are Moss Lake, Biscuit Brook, and Linn Run. The supplemental site was the MAP3S site at Pennsylvania State University that characterizes the central group of northern Appalachian streams. The site operators adhered by varying degrees to the sample collection protocol based on the daily sampling protocol of the MAP3S Precipitation Chemistry Network. Sulfate and nitrate ion together accounted for more than 80% of total anions (in μEq/L) in the precipitation at all sites. Wet deposition of sulfate at Moss Lake, Biscuit Brook, Penn State, and Linn Run averaged 223, 230, 253, and 402 mg/m^2/month, respectively, whereas nitrate wet deposition averaged 197, 195, 160, and 233 mg/m^2/month, respectively. Sulfate deposition was a factor of 2 to 4 higher in summer than in winter. The seasonal pattern for nitrate deposition was weak; the seasonal contrast was less than a factor of 2.5 at all sites. The association between the wet deposition and precipitation chemistry at the MAP3S monitoring site and the average for the study watersheds was dependent on the distance between the site and watershed and the intervening terrain. Precipitation chemistry at the monitoring site is representative of that at the ERP study watersheds in the Adirondack and Catskill regions and in the south-western group of watersheds in the Appalachian region. High spatial variability in precipitation amounts makes this assumption weaker for wet deposition. Chemical input to watersheds from dry deposition has not been determined at any site but could range from a factor of 0.3 to 1.0 of the wet deposition. 7 refs., 38 figs., 12 tabs.

7632 (SKB-TR-90-15) **Chemical and isotopic composition of groundwaters and their seasonal variability at the OSAMU**

Utsumi mine and Morro do Ferro analogue study sites, Pocos de Caldas, Brazil: Pocos do Caldas Report No. 6. Nordstrom, D.K. (U.S. Geological Survey, Menlo Park, CA (United States)); Smellie, J.A.T.; Wolf, M. Brazil; SKB(SE); NAGRA(CH); DOE(GB); DOE(US) collaboration. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). 1990. 122p. Order Number DE92613512. Source: OSTI; NTIS (US Sales Only); INIS.

Groundwaters and a few surface waters were collected over a period of 3 years from two natural analogue sites near Pocos de Caldas, Brazil: the Osamu Utsumi uranium mine and the Morro do Ferro thorium/rare-earth deposit. These were analysed for major constituents, several trace elements, tritium, deuterium and ^{18}O, to provide hydrochemical data for the modelling objectives as defined within the natural analogue study programme. The groundwaters are K-Fe-SO_4 type, which classifies them as a highly unusual composition related to the weathering of a hydrothermally altered, mineralised complex of volcanic to sub-volcanic phonolites. A subset of selected constituents (Fe(II), Fe(total), SO_4, pH, Eh, alkalinity, F and U) was monitored to gain detailed information on the seasonal variability. Seasonal patterns were only apparent from the very shallow groundwater data, but a trend of continuously increasing dissolved solids for the furthest down-gradient sampling point in deep groundwater indicates a growing plume of water affected by pyrite oxidation but without the residual acidity. Tritium and stable isotope measurements indicate that all groundwaters are of meteoric origin and are not affected significantly by evaporation or by water-rock interactions. Recharging groundwaters at both study site demonstrate infiltration of water of less than about 35 years in age, whereas deep groundwaters are below 1 TU (tritium unit) but still contain detectable tritium in most cases. These deeper groundwaters may be interpreted as being 35-60 or more years in age, resulting mainly from an admixture of younger with older groundwaters and/or indicating the influence of subsurface-produced tritium. (au).

55 BIOMEDICAL SCIENCES, BASIC STUDIES

7633 (DOE/ER/60437–6) **Electron microscope studies: Progress report, 1 July 1990–1 June 1991.** Crewe, A.V.; Kapp, O.H. Chicago Univ., IL (United States). 1 Jun 1991. 141p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER60437. Order Number DE92004693. Source: OSTI; NTIS; INIS; GPO Dep.

This year our laboratory has continued to make progress in the design of electron-optical systems, in the study of structure-function relationships of large multi-subunit proteins, in the development of new image processing software and in achieving a workable subangstrom STEM. We present an algebraic approach to the symmetrical Einzel (unipotential) lens wherein we simplify the analysis by specifying a field shape that meets some preferred set of boundary or other conditions and then calculate the fields. In a second study we generalize this approach to study of three element electrostatic lenses of which the symmetrical Einzel lens is a particular form. The purpose is to develop a method for assisting in the design of a lens for a particular purpose. In our biological work we study a stable and functional dodecameric complex of globin chains from the hemoglobin of Lumbricus terrestris. This is a complex lacking the "linker" subunit first imaged in this lab and required for maintenance of the native structure. In addition, we do a complete work-up on the hemoglobin of the marine polychaete Eudistylia vancouverii demonstrating the presence of a hierarchy of globin complexes. We demonstrate stable field-emission in the sub-angstrom STEM and the preliminary alignment of the beam. We continue our exploration of a algorithms for alignment of sequences of protein and DNA. Our computer facilities now include four second generation RISC workstations and we continue to take increasing advantage of the floating-point and graphical performance of these devices.

5501 Behavioral Biology

Refer also to citation(s) 6508, 6509, 6510, 6511, 6512, 6777, 7643

5502 Biochemistry

Refer also to citation(s) 7483, 7642, 7647, 7679, 7680, 7682, 7683

7634 (ANL–91/29) **Automated insertion of sequences into a ribosomal RNA alignment: An application of computational linguistics in molecular biology.** Taylor, R.C. Argonne National Lab., IL (United States). Nov 1991. 101p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. Order Number DE92004954. Source: OSTI; NTIS; GPO Dep.

Thesis submitted to Case Western Reserve University, Cleveland, OH.

This thesis involved the construction of (1) a grammar that incorporates knowledge on base invariancy and secondary structure in a molecule and (2) a parser engine that uses the grammar to position bases into the structural subunits of the molecule. These concepts were combined with a novel pinning technique to form a tool that semi-automates insertion of a new species into the alignment for the 16S rRNA molecule (a component of the ribosome) maintained by Dr. Carl Woese's group at the University of Illinois at Urbana. The tool was tested on species extracted from the alignment and on a group of entirely new species. The results were very encouraging, and the tool should be substantial aid to the curators of the 16S alignment. The construction of the grammar was itself automated, allowing application of the tool to alignments for other molecules. The logic programming language Prolog was used to construct all programs involved. The computational linguistics approach used here was found to be a useful way to attach the problem of insertion into an alignment.

7635 (ANL/CP–74444) **Polymerization of immunoglobulin domains: A model system for the development of facilitated macromolecular assembly.** Stevens, F.J.; Myatt, E.A. Argonne National Lab., IL (United States). [1991]. 27p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-9111148–1: 2. foresight conference on molecular nanotechnology, Palo Alto, CA (United States), 7-9 Nov 1991). Order Number DE92004723. Source: OSTI; NTIS; GPO Dep.

We have recently determined that monoclonal immunoglobulin light chains (Bence Jones proteins) are capable of reversible polymerization at room temperature. This property, as exhibited by immunoglobulin light chains (normally a component of an intact antibody molecule), may have novel implications for the development of "molecular nanotechnology." The polymerization capability of the immunoglobulin light chain is associated with the so-called variable domain of this molecule. The variable domain is a durable, compact beta-sheet structure of molecular weight approximately 12,000. Most of the primary sequence variation is limited to one portion of the molecule, that portion associated with the contribution of immunoglobulin light chains to the recognition and binding of thousand of different antigens by antibodies. As a consequence of these variations, different light chains polymerize with different degrees of avidity, from negligible to extensive. The polymerization process depends on solution parameters such as Ph. Thus, polymerization might be induced at one pH and suppressed or reversed at another. Combinations of molecules of appropriate specificities could assemble into structures of predetermined three-dimensional forms and properties. These features suggest that Bence Jones proteins represent a powerful model system within which to develop empirical rules relevant to a technology of protein-based "construction". Development of these rules will require the combined efforts of biophysical and crystallographic studies, protein engineering, and molecular modeling. 53 refs., 5 figs.

7636 (CONF-920330–1) **GRAIL: An integrated artificial intelligence system for gene recognition and interpretation.** Guan, X.; Mann, R.C.; Einstein, J.R.; Mural, R.J.; Uberbacher, E.C. Oak Ridge National Lab., TN (United States). [1991]. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 8. IEEE conference on artificial intelligence for applications; Monterey, CA (United States); 2-6 Mar 1992. Order Number DE91018850. Source: OSTI; NTIS; GPO Dep.

This paper describes the development of an integrated Artificial Intelligence system GRAIL (Gene Recognition and Analysis Internet Link). This system uses a combination of multiple sensor neural network, expert system, and parallel search tools to recognize and interpret genes in DNA sequences. A simple electronic mail (E-mail) interface makes the system accessible through Internet. The strength of our system in recognizing and interpreting genes in DNA sequences and the simple E-mail interface have already attracted more than 30 users. The successful integration of neural network, expert system and highly parallel search tools to solve such a complicated problem as gene interpretation indicates that the technology itself is likely to have many applications in solving other problems. 6 refs.

7637 (DOE/ER/60406–T5) **[Structure and stability of nucleic acids]: Progress report, July 1, 1988–June 30, 1991.** Tinoco, I. Jr. California Univ., Berkeley, CA (United States). [1991]. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract FG03-86ER60406. Order Number DE92003461. Source: OSTI; NTIS; GPO Dep.

We study the conformations of DNA and RNA oligonucleotides in order to understand their biological roles. We have determined the structure of the most common type of hairpin loop found in ribosomal RNA–the extra-stable tetraloop. It is actually a biloop with the other two bases in the loop forming a non-Watson-Crick base pair. This is the highest resolution structure reported for an RNA molecule in solution so far. We have obtained structures of pseudoknots and we have deduced general rules for their formation. We are presently studying a pseudoknot which is necessary for the replication of a retrovirus. The research done in the laboratory has been reported in 24 publications, plus 7 manuscripts in press or submitted. The research was done by 14 graduate students and 7 postdoctoral fellows. Five graduate students have received their Ph.D.s and 4 postdoctorals have finished their stay here. There are presently 9 graduate students and 3 postdoctorals working on the project; 2 new postdoctorals are expected this summer. One undergraduate student usually participates in the research during the year; this summer two undergraduates are working on the project. 31 refs., 4 figs.

7638 (LA-UR–91-3715) **HIV-1 intrapatient sequence diversity in the immunogenic V3 region.** Korber, B. (Los Alamos National Lab., NM (United States)); Myers, G.; Wolinsky, S.; Kunstman, K.; Levy, R.; Furtado, M.; Otto, P.; Haynes, B. Los Alamos National Lab., NM (United States). 12 Nov 1991. 15p. Sponsored by U.S. Department of Health and Human Services. DOE Contract W-7405-ENG-36. (CONF-9110295–1: Advances in aids vaccine development, Marcos Island, FL (United States), 15-19 Oct 1991). Order Number DE92003782. Source: OSTI; NTIS; GPO Dep.

The third hypervariable domain (V3) of the human immunodeficiency virus type-1 (HIV-1) envelope protein (env) can serve as an epitope for potent type-specific neutralizing antibodies (NAbs) – thus short peptides predicted on the most commonly found variants of the antigenic tip of the V3 loop have been considered as potential candidates for an HIV peptide vaccine. To evaluate the extent of intrapatient variation in the immunogenic crest of the V3 loop, sequence sets were analyzed from individuals for whom multiple V3 sequences were available. Several strategies for selecting the best sets of hexapeptides to represent the variable tip of the V3 loop were considered and their effectiveness was evaluated by comparing them with the sequence sets from individuals. Most individuals carried at least one, and frequently many, variants that did not match any of the sequences from among the ten most common hexapeptides. Intrapatient viral sequence variation was increased by including sequences derived from brain biopsy specimens as well as from blood. Additionally, sequences obtained from brain specimens of different individuals had common elements which were not conserved in the corresponding blood samples, suggesting that certain amino acids in the V3 loop may be requisite for viral propagation in the CNS.

7639 (LA-UR–91-3716) **Analyses of inter- and intra-patient variation in the V3 loop of the HIV-1 envelope protein.** Korber, B. (Los Alamos National Lab., NM (United States)); Myers, G.; Wolinsky, S. Los Alamos National Lab., NM (United States). 17 Sep 1991. 16p. Sponsored by U.S. Department of Health and Human Services. DOE Contract W-7405-ENG-36. (CONF-9109315–1: Vaccines '92, Cold Spring Harbor, NY (United States), 19-23 Sep 1991). Order Number DE92003781. Source: OSTI; NTIS; GPO Dep.

The third hypervariable domain of the HIV-1 gp120 envelope protein (V3) has been the focus of intensive sequencing efforts. To date, nearly one thousand V3 loop sequences have been stored in the HIV sequence database. Studies have revealed that the V3 loop elicits potent type-specific immune responses, and that it plays a significant role in cell tropism and fusion . The immunogenic tip of the loop can serve as a type-specific neutralizing antibody epitope, as well as a cytotoxic T-cell epitope. A helper T-cell epitope that lies within the amino terminal half of the V3 loop has also been characterized. Despite the richness of the immunologic response to this region, its potential for variation makes it an elusive target for vaccine design. Analyses of sibling sequence sets (sets of viral sequences derived from one person) show that multiple forms of the immunogenic tip of the loop are found within most HIV-1 infected individuals. Viral V3 sequences obtained from epidemiologically unlinked individuals from North America and Europe show extensive variation. However, some amino acid positions distributed throughout the V3 loop are highly conserved, and there is also conservation of the charge class of amino acid able to occupy certain positions relative to the tip of the loop. By contrast, the sequences obtained from many countries throughout the African continent reveal that V3 is a remarkably fluid region with few absolute constraints on the nature of the amino acids that can occupy most positions in the loop. The high degree of heterogeneity in this region is particularly striking in view of its contribution to biologically important viral functions.

7640 **Improved method for sequencing DNA base pairs.** Sessler, A.M.; Dawson, J. To Dept. of Energy. 1990. Filed date 30 May 1990. USA Patent patent application 7-530,693. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE92004622. Source: OSTI; NTIS; GPO Dep.

The base pairs of a DNA structure are sequenced with the use of a scanning tunneling microscope (STM). The DNA structure is scanned by the STM probe tip, and, as it is being scanned, the DNA structure is separately subjected to a sequence of infrared radiation from four different sources, each source being selected to preferentially excite one of the four different bases in the DNA structure. Each particular base being scanned is subjected to such sequence of infrared radiation from the four different sources as that particular base is being scanned. The DNA structure as a whole is separately imaged for each subjection thereof to radiation from one only of each source. 1 ref.

5503 Cytology

Refer also to citation(s) 7684, 7685, 7744, 7802

5504 Genetics

Refer also to citation(s) 7499, 7637, 7638, 7639, 7680, 7682, 7683

7641 (CONF-9106303–, pp. 59-60) **Genetics of coal biliquefaction by Neurospora crassa.** Mishra, N.C. (Univ. of South Carolina, Columbia (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-88PC88936. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

The main objectives of this proposal include: (1) isolation faction; (2) identification of coal derived products obtained after biosolubiliation in vitro; (3) selection of Neurospora strain capable of efficient coal liquefaction and biochemical characterization of mutants. A 84 kd protein with Coal Solubilization Activity (CSA) has been identified from the wildtype strain of Neurospora crassa, a filamentous fungus. This progein has been now very well characterized with respect to pH of Coal Solubiliation Activity, molecular weight, amino acid composition and heat stability. The protein has been found to be altered in a Neurospora mutant (ty-1) which is unable to solubilize coal. The mutant protein is altered with respect to its reduced stability, glycosylation pattern and isoelectric point (PI). These findings conclusively establish that Coal Solubilization is genetically controlled and that the above 84 kd Neurospora protein is involved in the Solubilization of Coal. Further study is aimed at determining the mechanism of the action of this 84 kd Neurospora protein.

7642 (DOE/ER/13204-6) **Genetics of thermophilic bacteria: Final progress report, May 1, 1984-April 30, 1991.** Welker, N.E. Northwestern Univ., Evanston, IL (United States). Dept. of Biochemistry, Molecular Biology and Cell Biology. [1991]. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-84ER13204. Order Number DE92004033. Source: OSTI; NTIS; GPO Dep.

Organisms adapted to high temperature have evolved a variety of unique solutions to the biochemical problems imposed by this environment. Adaptation is commonly used to describe the biochemical properties of organisms which have become adapted to their environment (genetic adaptation). It can also mean the direct response-at the cellular level-of an organism to changes in temperature (physiological adaptation). Thermophilic bacilli (strains of Bacillus stearothermophilus) can exhibit a variety of biochemical adaptations in response to changes in temperature. These include changes in the composition and stability of the membrane, metabolic potential, the transport of amino acids, regulatory mechanisms, ribose methylation of tRNA, protein thermostability, and nutritional requirements. The objectives of the research were to develop efficient and reliable genetic systems to analyze and manipulate B. Stearothermophilus, and to use these systems initiate a biochemical, molecular, and genetic investigations of genes that are required for growth at high temperature.

7643 (EGG-10617-2080) **San Joaquin kit fox (Vulpes macrotis mutica) program, Camp Roberts, California: Annual report, Fiscal years 1989-1990.** EG and G Energy Measurements, Inc., Goleta, CA (United States). Santa Barbara Operations. 1 Aug 1991. 46p. Sponsored by U.S. Department of Defense. DOE Contract AC08-88NV10617. Order Number DE92004459. Source: OSTI; NTIS (US Sales Only); GPO Dep.

Military training activities, new construction projects, and routine repair and maintenance activities conducted at Camp Roberts could adversely affect the endangered San Joaquin kit fox (Vulpes macrotis mutica). The Endangered Species Act of 1973 (as amended) states that all Federal agencies ensure that any actions authorized, funded, or carried out by the agency are not likely to have any detrimental effects on endangered species or their habitat. The major objective of the Camp Roberts Environmental Studies Program is to prepare a comprehensive Biological Assessment of the effects of all NGB-authorized activities (includes military training, anticipated construction projects, repair and maintenance activities, and all NGB-authorized non-military activities such as hunting and fishing programs, grazing leases, etc.) on San Joaquin kit fox. The program also provides NGB with the scientific expertise necessary to insure compliance with the Endangered Species Act. The specific objective of this report is to summarize progress and results of the Environmental Studies Program made during Fiscal Years 1989 and 1990 (FY89/90). 32 refs., 9 figs., 14 tabs.

7644 (LA-UR-91-3391) **The royal road for genetic algorithms: Fitness landscapes and GA performance.** Mitchell, M. (Michigan Univ., Ann Arbor, MI (United States)); Holland, J.H.; Forrest, S. Los Alamos National Lab., NM (United States). [1991]. 11p. Sponsored by U.S. DOE Office of Administration and Human Resource Management; Santa Fe Institute; Associated Western Universities. DOE Contract W-7405-ENG-36. (CONF-911266-1: 1. European conference on artificial life, Paris (France), Dec 1991). Order Number DE92002541. Source: OSTI; NTIS; GPO Dep.

Genetic algorithms (GAs) play a major role in many artificial-life systems, but there is often little detailed understanding of why the GA performs as it does, and little theoretical basis on which to characterize the types of fitness landscapes that lead to successful GA performance. In this paper we propose a strategy for addressing these issues. Our strategy consists of defining a set of features of fitness landscapes that are particularly relevant to the GA, and experimentally studying how various configurations of these features affect the GA's performance along a number of dimensions. In this paper we informally describe an initial set of proposed feature classes, describe in detail one such class ("Royal Road" functions), and present some initial experimental results concerning the role of crossover and "building blocks" on landscapes constructed from features of this class. 27 refs., 1 fig., 5 tabs.

7645 (PNL-7600-Pt.1, pp. 109-112) **GnomeView 2: A graphical interface to the human genome.** Douthart, R.J. Pacific Northwest Lab., Richland, WA (United States). Jun 1991. In *Pacific Northwest Laboratory annual report for 1990 to the DOE Office of Energy Research. Part 1, Biomedical sciences.* 151p. Order Number DE91015807. Source: OSTI; NTIS.

GnomeView is a graphical computer interface to the human genome. The central units of information organization are genome maps and DNA sequence. Although GnomeView contains its own Data Base management System (DBMS), it is not a data repository such as GenBank and Genetics Data Base (GDB). GnomeView is guided by user queries, and abstracts information from these databases to draw genomic maps. Currently information is abstracted automatically from GenBank but must be abstracted manually from GDB (Genome Data Base) and other sources of mapping information.

7646 (PNL-7600-Pt.1, pp. 113-115) **Synthesis of human genome information.** Schmaltz, J.E. Pacific Northwest Lab., Richland, WA (United States). Jun 1991. In *Pacific Northwest Laboratory annual report for 1990 to the DOE Office of Energy Research. Part 1, Biomedical sciences.* 151p. Order Number DE91015807. Source: OSTI; NTIS.

Computer science expertise was provided to the Human Genome Task Group by an OHER detailee. The Human Genome community uses the term 'informatics' to refer to computation, analysis, and database components of this multidisciplinary effort. Expertise in the area of informatics was provided, including reviewing research proposals, facilitating interagency and interlaboratory cooperation, liaising with the Human Genome newsletter group at Oak Ridge National Laboratory, and representing the US Department of Energy at technical meetings.

5505 Metabolism

Refer also to citation(s) 6296, 7680

7647 (DOE/ER/12027-6) **[Regulation of terpene metabolism: Final report].** Croteau, R. Washington State Univ., Pullman, WA (United States). Inst. of Biological Chemistry. [1991]. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract AT06-82ER12027. Order Number DE92004298. Source: OSTI; NTIS; GPO Dep.

We have completed studies on the key pathways of monoterpene biosynthesis in sage and peppermint, and on biosynthetic enzymes. We have confirmed that monoterpene turnover does occur, have deciphered the function of this process in plants, delineated the essential features of the catabolic pathways for camphor and menthone, and initiated studies on the relevant enzymology. We have made a strong case, based on analytical, in vivo, and in vitro studies, that terpene accumulation (yield and composition) depends on the balance between biosynthetic and catabolic events, and provided supporting evidence that these processes are developmentally regulated and very closely associated with senescence (collapse) of the oil glands. We have demonstrated that foliar applied bioregulators influence terpene composition and yield, probably by a combination of effects in oil gland development and by more direct alteration of enzyme levels. These studies have provided a practical means for modifying terpene composition and yield and, moreover, have provided a powerful approach to studying developmental regulation in intact plants, explants and tissue culture systems. We have thus developed the fundamental background knowledge needed as well as the necessary experimental tools for studying the regulation of terpene metabolism.

5506 Medicine

Refer also to citation(s) 6691, 6800, 8401

7648 (DOE/ER/60639–4) **Radiopharmaceuticals for diagnosis and treatment: Progress report.** Kuhl, D.E. Michigan Univ., Ann Arbor, MI (United States). [1991]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER60639. Order Number DE92004065. Source: OSTI; NTIS; GPO Dep.

In this grant period we have continued our efforts in the areas of PE basic radiochemistry, radiopharmaceutical synthesis, and preclinical radiopharmaceutical evaluation. A new synthetic sequence, consisting, of no-carrier-added fluorine-18 labeling of substituted benzaldehydes followed by reductive decarbonylation, has been developed. This new methodology can be applied to the fluorine-18 labeling of a wide variety of drugs not previously accessible through existing fluorine-18 labeling methods. Following up on a literature report that the ability to radiolabel aromatic rings can be predicted by ^{13}C-NMR chemical shifts, we have examined the generality of this correlation in aromatic rings bearing a variety of substituents. Although the original correlation holds for nitro substituted anisaldehydes, it cannot be extended to other rings substitution patterns. We have examined the relationship of in vivo localization of various fluorine-18 labeled dopamine uptake inhibitors to their in vitro binding affinities and lipophilicities. We have found that remarkably small decreases in binding affinity result in dramatic losses of in vivo binding to the desired high affinity binding sites. In order to probe the effects of endogenous neurotransmitter on the in vivo binding of radiolabeled dopamine uptake inhibitors, we have examined the in vivo regional localization of $[18_F]$ GBR 13119 after acute and chronic drug treatments which alter the endogenous levels of dopamine. We have found that acute changes in dopamine levels do not affect the binding of this radioligand, but chronic depletion of neurotransmitter results in down-regulation of the in vivo binding sites. 16 refs., 2 figs., 1 tab.

7649 (IAEA-TECDOC–613) **Nuclear and related techniques in the control of communicable diseases: Proceedings of regional seminars held in Bombay, India, 21-25 November 1988 and Belo Horizonte, Brazil, 30 October - 3 November 1989.** International Atomic Energy Agency, Vienna (Austria). Jul 1991. 194p. (CONF-881150–: IAEA seminar for Asia and the Pacific on nuclear techniques in communicable and parasitic infections, Bombay (India), 21-25 Nov 1988). Order Number DE92613626. Source: OSTI; NTIS (US Sales Only); INIS.

The IAEA has a programme component entitled "Nuclear Techniques in Communicable Diseases", the aims of which are to encourage research in the development of new methods of controlling communicable diseases and to transfer the technology to institutes in endemic regions. Implementation of the programme component includes information exchange through publications, symposiums and seminars. The two most recent seminars were held in Bombay in November 1988 and Belo Horizonte in November 1989, and a selection of the papers presented have been published in this Technical Document. Refs, figs and tabs.

7650 (IAEA-TECDOC–613, pp. 9-16) **Nuclear applications in parasitic and communicable infections.** Phillips, S.M. (Pennsylvania Univ., Philadelphia, PA (United States). School of Medicine). International Atomic Energy Agency, Vienna (Austria). Jul 1991. (CONF-881150–: IAEA seminar for Asia and the Pacific on nuclear techniques in communicable and parasitic infections, Bombay (India), 21-25 Nov 1988). In *Nuclear and related techniques in the control of communicable diseases: Proceedings of regional seminars held in Bombay, India, 21-25 November 1988 and Belo Horizonte, Brazil, 30 October - 3 November 1989.* 194p. Order Number DE92613626. Source: OSTI; NTIS (US Sales Only); INIS.

Nuclear techniques provide powerful tools for the study of communicable diseases. They are used in epidemiological surveys to determine the incidence and prevalence of disease, as well as to diagnose current infection and monitor the efficacy of chemotherapy. The techniques provide a means to elucidate some of the mechanisms involved in pathogenesis and resistance resulting from host-parasite interactions, and have an important role in the development of control strategies. (author). 12 refs, 1 tab.

7651 (IAEA-TECDOC–613, pp. 27-32) **DNA technologies for diagnostics and vaccines for infectious diseases.** Notani, N.K. (Bhabha Atomic Research Centre, Bombay (India). Biomedical Group). International Atomic Energy Agency, Vienna (Austria). Jul 1991. (CONF-881150–: IAEA seminar for Asia and the Pacific on nuclear techniques in communicable and parasitic infections, Bombay (India), 21-25 Nov 1988). In *Nuclear and related techniques in the control of communicable diseases: Proceedings of regional seminars held in Bombay, India, 21-25 November 1988 and Belo Horizonte, Brazil, 30 October - 3 November 1989.* 194p. Order Number DE92613626. Source: OSTI; NTIS (US Sales Only); INIS.

In certain parts of the world infectious diseases are still a big problem. Although chemotherapy and the control of the vector, where involved, would be the methods of choice for eradication of the disease, development of resistance to either the antibiotic or the pesticide require that other methods are also applied. Vaccination has been highly successful in controlling some diseases. A potential for such applications exists also in diseases like encephalitis, leprosy, leishmaniasis and malaria which are caused by a virus, a bacterium and parasites respectively. At least three of these diseases are in an epidemic form in North India. There is a tremendous hope that new recombinant DNA and nuclear techniques will not only be of help in an early and swift diagnosis of the disease-causing organism but also in the development of vaccines. This article deals with some of the recent progress made in the diagnosis and vaccine production of these diseases. (author). 12 refs.

7652 (IAEA-TECDOC–613, pp. 37-42) **Use of radiolabeled nucleic acid probes for the detection and identification of infectious organisms.** Tenover, F.C. (Seattle Veterans Affairs Medical Center, Seattle, WA (United States)). International Atomic Energy Agency, Vienna (Austria). Jul 1991. (CONF-881150–: IAEA seminar for Asia and the Pacific on nuclear techniques in communicable and parasitic infections, Bombay (India), 21-25 Nov 1988). In *Nuclear and related techniques in the control of communicable diseases: Proceedings of regional seminars held in Bombay, India, 21-25 November 1988 and Belo Horizonte, Brazil, 30 October - 3 November 1989.* 194p. Order Number DE92613626. Source: OSTI; NTIS (US Sales Only); INIS.

Nucleic acid probes can be used to detect and identify a wide variety of infectious organisms from bacteria to helminthic worms. Commercially-produced kits are now available for the direct detection of Legionella species in clinical samples, for identification of Mycobacterium species growing on solid media or in broth, and for detection of a variety of other bacteria and viruses directly in clinical samples or tissues. ^{32}P and ^{125}I, which are used to label probes to high specific activity, continue to be used in commercially-prepared kits. ^{32}P-labeling remains as one of the most sensitive means of labeling nucleic acids probes. The advantages of using probes to detect and identify infectious agents include the rapid generation of results, the ability to broaden the spectrum of organisms identified by a clinical laboratory, and the high specificity of probe-based tests. The disadvantages of using probes include the high cost of the assays, the additional equipment required, and the inability to perform ancillary tests, such as antimicrobial susceptibility testing, which require having a pure culture of the organism available. None-the-less, nucleic acid probes already are having a very positive impact on the diagnosis of infectious diseases both in the industrialized and developing nations. (author). 11 refs.

7653 (IAEA-TECDOC–613, pp. 43-50) **Detection of Brugia malayi infected mosquitoes with a species specific DNA probe.** Kurniawan, L. (National Inst. of Health Research and Development, Jakarta (Indonesia). Communicable Diseases Research Centre); Harun, S.; Sim, B.K.L.; Piessens, W.F.; Atmosoedjono, S. International Atomic Energy Agency, Vienna (Austria). Jul 1991. (CONF-881150–: IAEA seminar for Asia and the Pacific on nuclear techniques in communicable and parasitic infections, Bombay (India), 21-25 Nov 1988). In *Nuclear and related techniques in the control of communicable diseases: Proceedings of regional seminars held in Bombay, India, 21-25 November 1988 and Belo Horizonte, Brazil, 30 October - 3 November 1989.* 194p. Order Number DE92613626. Source: OSTI; NTIS (US Sales Only); INIS.

A species specific DNA probe (pβm15) was used in a field area where two filarial infections coexist: Brugia malayi in man and Brugia pahangi in cats. In our laboratory at Jakarta, this DNA probe proved to be sensitive enough to detect 500 pg of purified Brugia malayi microfilarial DNA. One to two infective larvae of Brugia malayi could be detected with ease. This DNA probe did not react with infective larvae of Brugia pahangi, Wuchereria bancrofti and Dirofilaria spp. Mosquitoes, which are vectors in Riau, were collected and fed on microfilaremic patients of Riau. The set of mosquitoes were tested in parallel with mosquitoes infected with Brugia pahangi from cats. All fed mosquitoes were tested after 10-12 days. Only mosquitoes infected with Brugia malayi reacted with the assay. This study shows that we have succeeded in applying the DNA probe technique in Jakarta. Further application in the field should be encouraged, with some modification of the DNA probing techniques for cheaper and easier implementation. 6 refs, 3 figs, 1 tab.

7654 (IAEA-TECDOC-613, pp. 69-72) **The use of DNA probes in the detection of P. falciparum in asexual blood stage.** Prapanthadara, L. (Chiang Mai Univ., Chiang Mai (Thailand). Research Inst. for Health Sciences); Panyim, S.; Vilaseneekul, P. International Atomic Energy Agency, Vienna (Austria). Jul 1991. (CONF-881150-: IAEA seminar for Asia and the Pacific on nuclear techniques in communicable and parasitic infections, Bombay (India), 21-25 Nov 1988). In *Nuclear and related techniques in the control of communicable diseases: Proceedings of regional seminars held in Bombay, India, 21-25 November 1988 and Belo Horizonte, Brazil, 30 October - 3 November 1989.* 194p. Order Number DE92613626. Source: OSTI; NTIS (US Sales Only); INIS.

A clone, pUN K1-45, containing a 3.9 Kb fragment from the P. falciparum Thai isolate K1, was constructed. This clone was specifically hybridized with P. falciparum DNA and not with other plasmodial species, e.g., P. knowlesi, P. cynomolgi, P. chabaudi and P. vivax nor with man and mosquito. It was able to detect P. falciparum infected blood at parasitemia levels of 0.005%. Dot blot hybridization, using pUN K1-45 as DNA probe revealed that this clone could detect 17 isolates of P. falciparum infected blood from northern Thailand. (author). 8 refs, 2 figs.

7655 (IAEA-TECDOC-613, pp. 73-77) **DNA probes for detecting the human papilloma virus.** Low, S.H. (National Univ. of Singapore (Singapore). Dept. of Microbiology); Yap, E.H.; Thong, T.W.; Singh, M.; Chan, Y.C.; Ho, T.H.; Lee, Y.S. International Atomic Energy Agency, Vienna (Austria). Jul 1991. (CONF-881150-: IAEA seminar for Asia and the Pacific on nuclear techniques in communicable and parasitic infections, Bombay (India), 21-25 Nov 1988). In *Nuclear and related techniques in the control of communicable diseases: Proceedings of regional seminars held in Bombay, India, 21-25 November 1988 and Belo Horizonte, Brazil, 30 October - 3 November 1989.* 194p. Order Number DE92613626. Source: OSTI; NTIS (US Sales Only); INIS.

Epidemiological studies have long indicated that dysplasia and cancer of the cervix uteri are of venereal origin and the sexually transmitted infective agent is the human papilloma virus (HPV). Various hybridization methods for the detection and typing of HPV are presented. Also a comparison of the 3 detection methods carried out by our laboratory is reported. (author). 14 refs, 2 tabs.

7656 (IAEA-TECDOC-613, pp. 79-84) **Cloning and characterization of Trypanosoma cruzi antigens bearing repetitive epitopes.** Goldenberg, S. (Fiocruz, Rio de Janeiro (Brazil). Dept. de Bioquimica e Biologia Molecular); Krieger, M.A.; Lafaille, J.J.; Linss, J. International Atomic Energy Agency, Vienna (Austria). Jul 1991. (CONF-8910558-: IAEA seminar for Latin America on nuclear techniques in parasitic and communicable diseases, Belo Horizonte (Brazil), 30 Oct - 3 nov 1989). In *Nuclear and related techniques in the control of communicable diseases: Proceedings of regional seminars held in Bombay, India, 21-25 November 1988 and Belo Horizonte, Brazil, 30 October - 3 November 1989.* 194p. Order Number DE92613626. Source: OSTI; NTIS (US Sales Only); INIS.

The genes of Trypanosoma cruzi, the causative agent of Chagas Disease, were cloned in the expression vector lambda gt11, and screened with a trypamastigote antiserum. Twelve clones expressing fusion proteins reacting to the antiserum were selected and further analysed in the western blot. One clone (7/2) expressing an antigen present in the cytoplasm of the parasite was found to react specifically with chagasic sera and may have potential as an immunodiagnostic reagent. (author). 11 refs, 4 figs.

7657 (IAEA-TECDOC-613, pp. 85-97) **Identification, characterization and cloning of Entamoeba histolytica adhesins: Their potential use in diagnosis.** Orozco, E. (Instituto Politecnico Nacional, Mexico City (Mexico). Centro de Investigacion y de Estudios Avanzados); Ayala, P.; Rodriguez, M.A.; Vargas, M.A.; Garcia-Rivera, G.; Hernandez, F.; Gonzalez-Robles, A.; Arroyo, R. International Atomic Energy Agency, Vienna (Austria). Jul 1991. (CONF-8910558-: IAEA seminar for Latin America on nuclear techniques in parasitic and communicable diseases, Belo Horizonte (Brazil), 30 Oct - 3 nov 1989). In *Nuclear and related techniques in the control of communicable diseases: Proceedings of regional seminars held in Bombay, India, 21-25 November 1988 and Belo Horizonte, Brazil, 30 October - 3 November 1989.* 194p. Order Number DE92613626. Source: OSTI; NTIS (US Sales Only); INIS.

Entamoeba histolytica adhesins were detected by the generation of monoclonal antibodies (MAbs) inhibitors of adhesion. In other experiments trophozoites were radiolabeled with ^{125}I or with (^{35}S)-methionine and incubated with red blood cells (RBS's) or epithelial MDCK cells. Labeled amebic proteins of 210, 160, 112, 90, 70, 50 and 24 kDa were detected adhered on RBCs. Iodinated MDCK proteins formed ligand-receptor complexes with amebic proteins of 112 kDa, 90 and 48 to 50 kDa, when incubated with amebic proteins separated by gel electrophoresis. When RBC's interacted with adherence-deficient mutants, used in this work as highly negative genetic controls, proteins of 112 and 90 kDa appeared diminished on RBS surface, in comparison with wild type strain. The 112 kDa adhesin was not detected in a monoxenic nonpathogenic E. histolytica strain, isolated from an asymptomatic carrier. An E. histolytica DNA library was constructed in lambda gt-11, and recombinant clones were selected using polyclonal antibodies against the 112 kDa adhesin. In spite of the fact that DNA of the parasite was cloned, production of the hybrid protein in Escherichia coli was relatively efficient. Correlation of the presence of adhesins with the virulence of E. histolytica trophozoites encourage us to propose these proteins and their antibodies as good candidates in the design of reliable and inexpensive diagnosis and vaccine methods. (author). 23 refs, 7 figs, 2 tabs.

7658 (IAEA-TECDOC-613, pp. 107-112) **RIA and ELISA as diagnostic tools in the study of filariasis.** Harinath, B.C. (Mahatma Gandhi Inst. of Medicinal Sciences, Sevagram, Wardha (India). Dept. of Biochemistry). International Atomic Energy Agency, Vienna (Austria). Jul 1991. (CONF-881150-: IAEA seminar for Asia and the Pacific on nuclear techniques in communicable and parasitic infections, Bombay (India), 21-25 Nov 1988). In *Nuclear and related techniques in the control of communicable diseases: Proceedings of regional seminars held in Bombay, India, 21-25 November 1988 and Belo Horizonte, Brazil, 30 October - 3 November 1989.* 194p. Order Number DE92613626. Source: OSTI; NTIS (US Sales Only); INIS.

The immunodiagnosis of filariasis has been a major challenge to the parasite immuno-chemist. Studies using in vitro and in vivo released antigens in immunoradiometric assay (IRMA) and Enzyme linked immunosorbent assay (ELISA) have shown good immunodiagnostic potential. Biosynthetically labelled Wuchereria bancrofti excretory-secretory (ES) antigen has been used in radioimmunoassay and compared with the ELISA system. As little as 60 pg ES antigen protein was found to be sufficient in detecting filarial antibody by stick ELISA. Similarly, an antigen fraction UFA C2A isolated from filarial patient's urine was found to be highly sensitive requiring as little as 500 attogram antigen protein per test. IgG fraction of human serum immunoglobulin (FSIgG) has been successfully used for the detection of filarial antigen in immune complexes, hydrocele fluid, filarial urine and sera. (author). 15 refs, 1 fig., 1 tab.

7659 (IAEA-TECDOC-613, pp. 113-119) **A study of antibody response in leprosy using solid phase radioimmunoassay with M. leprae specific neoglycoprotein (NT-O-BSA).** Praputpittaya, K. (Chiang Mai Univ., Chiang Mai (Thailand). Dept. of Clinical Immunology); Rungruengthanakit, K.;

Suriyanon, V. International Atomic Energy Agency, Vienna (Austria). Jul 1991. (CONF-881150–: IAEA seminar for Asia and the Pacific on nuclear techniques in communicable and parasitic infections, Bombay (India), 21-25 Nov 1988). In *Nuclear and related techniques in the control of communicable diseases: Proceedings of regional seminars held in Bombay, India, 21-25 November 1988 and Belo Horizonte, Brazil, 30 October - 3 November 1989.* 194p. Order Number DE92613626. Source: OSTI; NTIS (US Sales Only); INIS.

A solid phase radioimmunoassay (RIA) to study antibody response in leprosy was set up with natural trisaccharide-octyl-bovine serum albumin (NT-O-BSA), a Mycobacterium leprae (M. leprae)-specific synthetic antigen. Both IgM and all immunoglobulin (Igs) antibodies in sera of 62 lepromatous (28 new and 34 old LL/BL), 18 tuberculoid (TT/BT), 25 tuberculosis (TB) patients and 33 normal controls, were studied for their reactivities to the antigen using ^{125}I-labelled anti-human IgM and anti-human Igs, respectively. Binding activities and positivity rates (based on X+3SD of normal controls) of IgM antibodies were the highest in new LL/BL and moderate in TT/BT sera. Tuberculous and normal sera were devoid of IgM antibodies to the antigen. The same pattern of binding activities and positivity rates were also found for all Igs to the NT-O-BSA. However, positivity rates of all Igs were higher than those of IgM, particularly in sera of LL/BL and TT/BT. Only one out of fourteen TB and no normal sera were positive. Our results suggest that the RIA with this synthetic antigen is highly sensitive and specific to M. leprae injection and should be useful for serodiagnosis and also seroepidemiology of leprosy. (author). 10 refs, 1 fig., 1 tab.

7660 (IAEA-TECDOC–613, pp. 121-129) **Specificity of monoclonal antibodies and isolation of serospecific antigen of Mycobacterium tuberculosis.** Kadival, G.V. (Bhabha Atomic Research Centre, Bombay (India). Radiation Medicine Centre); Chaparas, S.D.; Hussong, D. International Atomic Energy Agency, Vienna (Austria). Jul 1991. (CONF-881150–: IAEA seminar for Asia and the Pacific on nuclear techniques in communicable and parasitic infections, Bombay (India), 21-25 Nov 1988). In *Nuclear and related techniques in the control of communicable diseases: Proceedings of regional seminars held in Bombay, India, 21-25 November 1988 and Belo Horizonte, Brazil, 30 October - 3 November 1989.* 194p. Order Number DE92613626. Source: OSTI; NTIS (US Sales Only); INIS.

Mouse monoclonal antibodies to M. tuberculosis were produced by conventional techniques where spleen cells from hyperimmunized Balb-c mice were fused with Sp2/0 myeloma cells using polyethylene glycol. Five clones were isolated designated as HGT1, HGT2, HGT3a, HGT4 and HGT6. Specificity and reactivity of these antibodies were tested by ELISA and immunoblot studies. HGT3a represented the most specific of the monoclonal antibodies produced and it was decided to isolate the antigen by affinity chromatography and study its humoral and cellular reactions. The specificity of the antigen was tested in a vertical study by immune detection on western blots reacted with hyperimmune sera against M. tuberculosis, M. bovis (BCG) and 10 other Mycobacterium species. The antigen was detected only by antisera to M. tuberculosis and M. bovis (BCG). Specificity in cell mediated immunity was tested by skin tests in guinea pigs sensitized with M. tuberculosis, Mycobacterium intracellulare and Mycobacterium kansasii and by lymphocyte proliferation tests. The 38 KDa antigen induced positive skin test reactions regardless of the Mycobacterium species used to sensitize the animal. Lymphocyte proliferation was observed in the presence of 38 KDa antigen, M. tuberculosis sonicate antigen, tuberculin purified protein derivative and to M. kansasii and M. intracellulare. The 38 KDa antigen appears to contain a specific epitope detected by serology but also contains epitopes that are cross-reactive for cell mediated immunity. 17 refs, 6 figs, 1 tab.

7661 (IAEA-TECDOC–613, pp. 131-136) **Comparison of immunoradiometric assay (IRMA) and liquid phase radioimmunoassay (LPRIA) in serodiagnosis of tuberculosis.** Lahiri, V.L. (S.N. Medical College, Agra (India). Post-Graduate Dept. of Pathology); Bhattacharjee, P.K.; Hazra, D.K. International Atomic Energy Agency, Vienna (Austria). Jul 1991. (CONF-881150–: IAEA seminar for Asia and the Pacific on nuclear techniques in communicable and parasitic infections, Bombay (India), 21-25 Nov 1988). In *Nuclear and related techniques in the control of communicable diseases: Proceedings of regional seminars held in Bombay, India, 21-25 November 1988 and Belo Horizonte, Brazil, 30 October - 3 November 1989.* 194p. Order Number DE92613626. Source: OSTI; NTIS (US Sales Only); INIS.

A comparison between conventional sandwich 2 site- 2 step-IRMA and Liquid Phase Radioimmunoassay (LPRIA) system in the detection of tubercular antigen in the various body fluids was attempted using the antibody tracer (murine monoclonal antibody WTB$_{72}$) in IRMA and antigen tracer in LPRIA using Anti-M duvelli. The positivity in pulmonary tuberculosis in the IRMA was 90.47% while in LPRIA it was 43.3%. Bone T.B. showed 60% positivity with IRMA and 71.47% with LPRIA. TBM cases showed 87.5% positivity with IRMA and 93.3% with LPRIA. In tubercular pleural effusion the positivity was 66.6% in IRMA and 85.7% in LPRIA while in tubercular ascites the positivity was 70% in IRMA and 85.7% in LPRIA. The comparison of sensitivity and specificity showed that in serum this IRMA works better while in pleural and ascitic fluid LPRIA is superior. (author). 6 refs, 5 tabs.

7662 (IAEA-TECDOC–613, pp. 137-142) **Detection of antigenemia in the body fluids of patients with tuberculosis by conventional 2-site immunoradiometric assay (IRMA).** Lahiri, V.L. (S.N. Medical College, Agra (India). Post-Graduate Dept. of Pathology); Bhattacharjee, P.K.; Hazra, D.K. International Atomic Energy Agency, Vienna (Austria). Jul 1991. (CONF-881150–: IAEA seminar for Asia and the Pacific on nuclear techniques in communicable and parasitic infections, Bombay (India), 21-25 Nov 1988). In *Nuclear and related techniques in the control of communicable diseases: Proceedings of regional seminars held in Bombay, India, 21-25 November 1988 and Belo Horizonte, Brazil, 30 October - 3 November 1989.* 194p. Order Number DE92613626. Source: OSTI; NTIS (US Sales Only); INIS.

The conventional 2-site immunoradiometric assay (IRMA) for the detection of tubercular antigen in various body fluids of 94 tubercular patients was developed using anti-tubercular murine monoclonal antibody, WTB$_{72}$. The positivity in sera of pulmonary tuberculosis was 90.4% only, and in bone, T.B. 60% with no false positive reaction in sera. CSF from the cases of Tubercular meningitis (TBM) showed 87.5% positivity with no false positivity in healthy control CSF, but one CSF from pyogenic meningitis showed a positive result. In tubercular pleural effusion, the positivity was 66.6% with no false positive result, while in Tubercular ascites positivity was 70% with 25% positivity in control ascites. 7 refs, 3 tabs.

7663 (IAEA-TECDOC–613, pp. 143-148) **Radioimmunoassay in the diagnosis of tuberculosis.** Ashtekar, M.D. (Bhabha Atomic Research Centre, Bombay (India). Radiation Medicine Centre); Samuel, A.M. International Atomic Energy Agency, Vienna (Austria). Jul 1991. (CONF-881150–: IAEA seminar for Asia and the Pacific on nuclear techniques in communicable and parasitic infections, Bombay (India), 21-25 Nov 1988). In *Nuclear and related techniques in the control of communicable diseases: Proceedings of regional seminars held in Bombay, India, 21-25 November 1988 and Belo Horizonte, Brazil, 30 October - 3 November 1989.* 194p. Order Number DE92613626. Source: OSTI; NTIS (US Sales Only); INIS.

A solid phase radioimmunoassay developed at the institute was evaluated for its ability to measure TB antigen and anti-TB antibody in patients with pulmonary and extrapulmonary tuberculosis. The TB antigen as well as the anti-TB antibody levels were significantly elevated in patients with tuberculosis in comparison with controls. Following treatment, the antigen levels fell in some of the patients with a concomitant rise in antibody. (author). 12 refs, 6 tabs.

7664 (IAEA-TECDOC–613, pp. 149-155) **Evaluation of immunoscintigraphic techniques in tuberculosis.** Malpani, B.L. (Bhabha Atomic Research Centre, Bombay (India). Radiation Medicine Centre); Kadival, G.V.; Samuel, A.M. International Atomic Energy Agency, Vienna (Austria). Jul 1991. (CONF-881150–: IAEA seminar for Asia and the Pacific on nuclear techniques in communicable and parasitic infections, Bombay (India), 21-25 Nov 1988). In *Nuclear and related techniques in the control of communicable diseases: Proceedings of regional seminars held in Bombay, India, 21-25 November 1988 and Belo Horizonte, Brazil, 30 October - 3*

November 1989. 194p. Order Number DE92613626. Source: OSTI; NTIS (US Sales Only); INIS.

The potential use of radiolabelled antibodies as an in vivo targeting agent in immunoscintigraphy for tuberculoma lesions, was studied in rabbits with experimentally induced lesions in the thigh. 300 μgCi of ^{131}I-anti-BCG antibody was injected i.v. and scintiscans taken 1 to 9 days later using a medium energy collimatory on GE Gamma Camera. Localization of the antibody was seen from the third day but significant concentration of the antibody was also noted in the background and major organs. By day 6, most of the background was clear with a minimum uptake in liver and kidneys. Non-specific scans using ^{131}I-BSA or 99mTC-RBC blood pool did not show any concentration at the site of lesion. (author). 11 refs, 3 figs.

7665 (INIS-BR--2849) **Separation of radioimmunoassay in magnetic phase with particles prepared at the IPEN and its comparison with conventional methodologies.** Araujo, E.A. de. Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, SP (Brazil). 1991 154p. (In Portuguese). Order Number DE92613668. Source: OSTI; NTIS (US Sales Only); INIS.

In the present work two main objectives were chosen. The first was the preparation for the execution of the magnetic phase separation technique, useful for the radioimmunoassay as well as for the most modern and most efficient immunoradiometric assay. The second objective, of a theoretical-practical kind and directly linked to the first, was the realization of a study about the precision of the technique with synthesized products compared with imported products and with two liquid phase separation techniques: the second antibody and polyethyleneglycol (PEG). This analysis was performed with the help of precision profiles built according to R.P.Ekins' recommendations. (author).

7666 (INIS-BR--2858) **The total plasmatic estriol on normal gestation.** Thiesen, A.L. Universidade do Estado, Rio de Janeiro, RJ (Brazil). Centro Biomedico. 1980 73p. (In Portuguese). Order Number DE92613669. Source: OSTI; NTIS (US Sales Only); INIS.

The total plasmatic estriol in normal pregnants was determinated by radioimmunological method using estriol labelled with sup(125)I. The obtained results presented similar results in comparison with methods using sup(19)C and sup(3)H. (author).

7667 (INIS-BR--2862) **Pulmonary arterio-venous micro fistulae - Diagnostic.** Ebram, J.C. Universidade do Estado, Rio de Janeiro, RJ (Brazil). Centro Biomedico. 1989 86p. (In Portuguese). Order Number DE92613670. Source: OSTI; NTIS (US Sales Only); INIS.

Four patients with pulmonary arterio-venous micro-fistulae - of which two were male (50%) - the ages varying from 10 to 43 (X sup(≈) = 22,7), were studied at the Cardiology Centre of the 6th Ward of Santa Casa da Misericordia Hospital in Rio de Janeiro. They were all basically suffering from Manson's Schistosomiasis, the hepato-splenic form in 3 cases (75%) and the Rendu Osler Weber disease with juvenile cirrhosis in 1 case (25%). All four of them had portal hypertension. The individual cases were clinically evaluate with X-rays, scintillographic and hemodynamic tests. (author).

7668 (INIS-BR--2883) **Proceedings of the 5. Latin American Meeting on Medical Physics; 2. Workshop on Medical Physics; 1. Workshop on Medical Physics and Biomedical Engineering.** Associacao Brasileira de Fisicos em Medicina, Rio de Janeiro, RJ (Brazil). 1990 61p. (In Portuguese). (CONF-9010386--: 12. Brazilian Congress on Biomedical Engineering and 5. Latin American Conference on Medical Physics, Ribeirao Preto (Brazil), 7-11 Oct 1990). Order Number DE92613627. Source: OSTI; NTIS (US Sales Only); INIS.

These meetings describe the works of research groups in latin american on medical physics, including technical aspects and the new ways for the development. (C.G.C.).

7669 (INIS-BR--2883, pp. 1) **Simulation of the radiographic techniques in thorax and fracture studies.** Brochi, M.A.C. (Sao Paulo Univ., Ribeirao Preto, SP (Brazil). Faculdade de Filosofia, Ciencias e Letras); Ghilardi Neto, T. Associacao Brasileira de Fisicos em Medicina, Rio de Janeiro, RJ (Brazil). 1990. 61p. (In Portuguese). (CONF-9010386--: 12. Brazilian Congress on Biomedical Engineering and 5. Latin American Conference on Medical Physics, Ribeirao Preto (Brazil), 7-11 Oct 1990). In *Proceedings of the 5. Latin American Meeting on Medical Physics; 2. Workshop on Medical Physics; 1. Workshop on Medical Physics and Biomedical Engineering.* Order Number DE92613627. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. BIOMEDICAL RADIOGRAPHY/simulation; ALGORITHMS; SIMULATION; BONE FRACTURES; CHEST; IMAGES; RADIATION DOSES

7670 (INIS-BR--2883, pp. 2) **Digital filtrate method for removing intense source in SPECT studies, implementation and evaluation.** Perez, A. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Dept. of Radiobiologia); Giannone, C.; Cabrejas, M.; Galli, R. Associacao Brasileira de Fisicos em Medicina, Rio de Janeiro, RJ (Brazil). 1990. 61p. (In Spanish). (CONF-9010386--: 12. Brazilian Congress on Biomedical Engineering and 5. Latin American Conference on Medical Physics, Ribeirao Preto (Brazil), 7-11 Oct 1990). In *Proceedings of the 5. Latin American Meeting on Medical Physics; 2. Workshop on Medical Physics; 1. Workshop on Medical Physics and Biomedical Engineering.* Order Number DE92613627. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. BLADDER/tomography; BLADDER; TOMOGRAPHY

7671 (INIS-BR--2883, pp. 26-31) **Project of a quality assurance programme for radiotherapy in Latin-America.** Plazas, M.C. (Hopital Tenon, 75 - Paris (France)); Dutreix, A. Associacao Brasileira de Fisicos em Medicina, Rio de Janeiro, RJ (Brazil). 1990. 61p. (CONF-9010386--: 12. Brazilian Congress on Biomedical Engineering and 5. Latin American Conference on Medical Physics, Ribeirao Preto (Brazil), 7-11 Oct 1990). In *Proceedings of the 5. Latin American Meeting on Medical Physics; 2. Workshop on Medical Physics; 1. Workshop on Medical Physics and Biomedical Engineering.* Order Number DE92613627. Source: OSTI; NTIS (US Sales Only); INIS.

A project of quality assurance programme for radiotherapy in Latin America is described to detect the systematic errors, decrease the random uncertainties and avoid the mistakes. (C.G.C.).

7672 (INIS-BR--2883, pp. 12-21) **Description of new techniques on interstitial brachytherapy in head and neck (oral cavity).** Marsiglia, H. (Hospital Tenon, 75 - Paris (France)). Associacao Brasileira de Fisicos em Medicina, Rio de Janeiro, RJ (Brazil). 1990. 61p. (In Spanish). (CONF-9010386--: 12. Brazilian Congress on Biomedical Engineering and 5. Latin American Conference on Medical Physics, Ribeirao Preto (Brazil), 7-11 Oct 1990). In *Proceedings of the 5. Latin American Meeting on Medical Physics; 2. Workshop on Medical Physics; 1. Workshop on Medical Physics and Biomedical Engineering.* Order Number DE92613627. Source: OSTI; NTIS (US Sales Only); INIS.

Several case of epidermoid carcinomas in buccal cavity treated by brachytherapy associated with others therapeutic techniques are described, including the results using different therapeutical methods and the clinical and technical parameters considered on the evolution of the disease. (C.G.C.).

7673 (INIS-mf--13072) **Moment problems in Hilbert space with applications to magnetic resonance imaging.** Zwaan, Marcel. Vrije Univ., Amsterdam (Netherlands). 28 Feb 1991 139p. Order Number DE92613631. Source: OSTI; NTIS (US Sales Only); INIS.

Includes summary in Dutch and subject index.

This thesis is concerned with the mathematical and computational aspects of reconstruction techniques by means of magnetic resonance imaging, in particular for the time-dependent case, referred to as dynamic MRI. The main subjects are: a mathematical framework for dynamic MRI reconstruction; analytic solutions, numerical algorithms and development of reconstruction techniques; stability analysis of the reconstruction algorithms; comparison between these algorithms. (author). 63 refs.; 38 figs.; 5 tabs.

7674 (INIS-mf--13077) **Gadolinium-DTPA enhanced MRI in myocardial infarction: An experimental and clinical study.** Dijkman, P.R.M. van. Rijksuniversiteit Leiden (Netherlands). 30 Oct

1991 163p. Order Number DE92613632. Source: OSTI; NTIS (US Sales Only); INIS.

Financially supported by the Interuniversity Cardiology Institute of The Netherlands, the Netherlands Heart Foundation, and the '3A out Fund' of the Department of Internal Medicine, University Hospital Leiden; includes summary in Dutch.

This thesis focuses on one aspect of cardiac magnetic resonance imaging (MRI) for noninvasive screening of ischemic heart disease: the identification and quantification of acutely infarcted myocardium using gadolineum-diethylene triamine pentaacetic acid (Gd-DTPA) enhanced T1-weighted MRI in a clinical and experimental setting. (author). 296 refs.; 34 figs.; 4 tabs.

7675 (INIS-mf–14018) **The occurrence of hyperthyroidism following administration of a contrast medium.** Buelhoff, D. Bochum Univ. (Germany). Medizinische Fakultaet. 13 Oct 1987 57p. (In German). Order Number DE92758944. Source: OSTI; NTIS (US Sales Only); INIS.

During the study described here attempts were made to establish a link between the occurrence of hyperthyreoidism and prior contamination with iodinated contrast media in connection with X-ray procedures, among which particular attention was given to lymphography. In a prospective study performed for that purpose five out of the 108 patients subjected to lymphography were found to develop hyperthyroidism, which manifested itself after a latency period of one month. Further retrospective analyses on the basis of 2453 patients receiving lymphography showed that among these individuals fifteen developed hyperthyroidism during the first year after the procedure. In all, twenty cases of hyperthyroidism occurred in this cohort within a period of two years and six months after lymphography. Retrospective studies were also performed in a group of patients showing excessive production of thyroid hormone who, according to their case reports, developed the disease within a period of up to three months after opacification of the bile ducts or urinary tract. Direct links could be established for 81 (16.6%) among the 499 patients questioned for this purpose. (orig.).

7676 (Juel–2509) **Radon therapy in the Soviet Union. Report on the visit to the National Research Center for Medical Rehabilitation and Physical Therapy in Moscow, September 18-20, 1990.** Sansoni, B. (Forschungszentrum Juelich GmbH (Germany). Zentralabteilung fuer Chemische Analysen); Andrejew, S.V. Forschungszentrum Juelich GmbH (Germany). Zentralabteilung fuer Chemische Analysen. Aug 1991. 181p. (In German). Order Number DE92750180. Source: OSTI; NTIS (US Sales Only); INIS.

In the Soviet Union approximately one million courses of radon treatment each lasting three weeks are prescribed every year. The curative application of radon used for cardiovascular diseases, including aftercare in cases of cardiac infarction, disorders of the locomotor system and joints and muscles, the male and female sexual system, diseases of the nervous system, endocrinology and metabolic diseases. Contraindication practice is similar to that in Central Europe. Radon is given to skin stimulation by wet and above all dry baths. The radiation exposure of patients from these three-week radon treatments is relatively low. The radon effect is interpreted as 'radiation flash' stimulating the nervous system. The skin plays a particular role in this process, acting as the stimulus acceptor. (orig./MG).

7677 (LUMEDW-MEXL–1022-1991) **Digital luminescence radiography of the chest: A clinical and experimental study.** Kehler, M. Lund Univ. (Sweden). Dept. of Diagnostic Radiology. Oct 1991. 28p. Order Number DE92613633. Source: OSTI; NTIS (US Sales Only); INIS.

The aim of the present study was to evaluate the efficacy of a digital system in chest radiology compared to the conventional film-screen system. The first studies (1-3) were purely clinical, had two parts, one clinical and one using phantoms, and the 5:th used solely phantoms. Except for the first - pilot - study, the studies were performed as receiver operating characteristic (ROC) analysis. From one exposure, two digital radiographs were obtained, one simulating the film-screen radiograph and one enhanced, using an unsharp mask. The conventional radiograph was compared to this double-image, but in addition to this, even to the simulated normal and enhanced separately (1-3). To evaluate the value of inverted (positive) radiographs, the original digital (negative) radiographs were inverted, and then compared to the originals (4). As digitzation means easy storing and transfer of data and possibility of electronic display, the diagnostic performance of an interactive workstation was assessed (5). In the clinical studies, a variety of chest affections were used: atelectasis, tumor, pneumothorax, fibrosis, mediastinal and bony changes, tuberculosis, incompensations and enlargement of the heart (1), pneumothorax (2), fibrosis (3), and tumor (4). In the phantom studies, test objects simulating tumors (4) and pneumothorax (5) were used. In no study was statistical significant difference seen between the digital and conventional system (p>0.05). Neither in the clinical nor the phantom study did inversion of the radiographs improve diagnostic performance. The workstation performed almost equally well as the radiographs even with a resolution of 1.25 1p/mm compared to the digital radiographs 2.5 and film-screen radiographs 5 1p/mm. (au) (50 refs.).

7678 (NUREG/CR–5798) **Pilot program to assess proposed basic quality assurance requirements in the medical use of byproduct materials.** Kaplan, E. (Brookhaven National Lab., Upton, NY (United States)); Nelson, K.; Meinhold, C.B. Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications. Oct 1991. 61p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC02-76CH00016. (BNL-NUREG–52303). Source: OSTI; NTIS; INIS; GPO.

In January 1990, the Nuclear Regulatory Commission (NRC) proposed amendments to 10 CFR Part 35 that would require medical licensees using byproduct material to establish and implement a basic quality assurance program. A 60-day real-world trial of the proposed rules was initiated to obtain information beyond that generally found through standard public comment procedures. Volunteers from randomly selected institutions had opportunities to review the details of the proposed regulations and to implement these rules on a daily basis during the trial. The participating institutions were then asked to evaluate the proposed regulations based on their personal experiences. The pilot project sought to determine whether medical institutions could develop written quality assurance programs that would meet the eight performance-based objectives of proposed Section 35.35. In addition, the NRC wanted to learn from these volunteers if they had any recommendations on how the rule could be revised to minimized its cost and to clarify its objectives without decreasing its effectiveness. It was found that licensees could develop acceptable QA programs under a performance-based approach, that most licensee programs did meet the proposed objectives, and that most written QA plans would require consultations with NRC or Agreement State personnel before they would fully meet all objectives of proposed Section 35.35. This report describes the overall pilot program. The methodology used to select and assemble the group of participating licensees is presented. The various workshops and evaluation questionnaires are discussed, and detailed findings are presented. 7 refs.

7679 **Acyclonucleosides of 2-nitroimidazole and uses as diagnostic and therapeutic agents.** Srivastava, P.C.; Hasan, A. To Dept. of Energy. 1990. Filed date 18 Jun 1990. USA Patent patent application 7-539,493. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE92003750. Source: OSTI; NTIS; GPO Dep.

An acyclonucleoside of nitroimidazole having the ability to specifically bind to tumor cells and useful for therapy, chemotherapy, imaging and radiosensitizing the tumor cells.

5507 Microbiology

Refer also to citation(s) 6113, 6129, 6130, 6133, 6141, 6184, 6185, 6186, 6187, 6296, 6297, 7506, 7638, 7639, 7641, 7642

7680 (CONF-911231–1) **Regulated bioluminescence as a tool for bioremediation process monitoring and control of bacterial cultures.** Burlage, R.S. (Oak Ridge National Lab., TN (United States)); Heitzer, A.; DiGrazia, P.M. Oak Ridge National Lab., TN (United States). [1991]. 11p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE

Contract AC05-84OR21400. From Technology 2000; San Jose, CA (United States); 3-5 Dec 1991. Order Number DE92002707. Source: OSTI; NTIS; GPO Dep.

An effective on-line monitoring technique for toxic waste bioremediation using bioluminescent microorganisms has demonstrated great potential for the description and optimization of biological processes. The lux genes of the bacterium Vibrio Fascheri are used by this species to produce visible light. The lux genes can be genetically fused to the control region of a catabolic gene, with the result that bioluminescence is produced whenever the catabolic gene is induced. Thus the detection of light from a sample (monoculture, consortium, or bioreactor) indicates that genetic expression from a specific gene is occurring. We have used this technique to monitor biodegradation of specific contaminants from waste sites. For these studies, fusions between the lux genes and the operons for naphthalene (nah) and toluene/xylene (xyl) degradation were constructed. Strains carrying one of these fusions respond sensitively and specifically to target substrates. Bioluminescence from these cultures can be rapidly measured in a non-destructive and non-invasive manner. The potential for this technique in this and other biological systems is discussed. 7 refs., 3 figs.

7681 (CONF-9106303–, pp. 77-78) **Microbial mineralization of coal-derived hydrophobic organic contaminants: The role of bio-surfactant/emulsifier and solubilization.** Luthy, R.G. (Carnegie Mellon Univ., Pittsburgh, PA (United States)). USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div. Jun 1991. DOE Contract FG22-90PC90303. From University coal research program at historically black colleges and universities; Pittsburgh, PA (United States); 25-27 Jun 1991. In *Abstracts and research accomplishments of university coal research projects.* 207p. Order Number DE92003115. Source: OSTI; NTIS.

This research addresses physico-chemical and biochemical solubilization and mineralization reactions for polycyclic aromatic hydrocarbon (PAH) compounds in coal tar. The emphasis of the investigation is on understanding the rate-controlling processes for microbial degradation of organic-phase PAH in the environment and in wastewater treatment processes through determination of the kinetics of solute solubilization and rates of mineralization. The project will evaluate abiotic and biotic solubilization phenomena, and explore possible synergistic interactions between PAH-degrading bacteria and bio-surfactant/emulsifier-producing organisms that have been shown to be potentially useful in coal biotechnology. PAH-degrading microorganisms have been cultured and prepared for use in mineralization tests. Bio-surfactant producing microorganisms have been procured and cultured. A protocol for assessing coal tar solubilization rates has been developed; this procedure is being evaluated.

7682 (DOE/ER/60989–2) **Phylogenetic relationships among subsurface microorganisms: Progress report.** Nierzwicki-Bauer, S.A. Rensselaer Polytechnic Inst., Troy, NY (United States). [1991]. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-90ER60989. Order Number DE92004421. Source: OSTI; NTIS; GPO Dep.

This project involves the development of group specific 16S ribosomal RNA-targeted oligonucleotide hybridization probes for the rapid detection of specific types of subsurface organisms (e.g., groups of microbes that share certain physiological traits). Major accomplishments for the period of 6/91 to 12/1/91 are described. Nine new probes have been synthesized on the basis of published 16S rRNA sequence data from the Ribosomal Database Project. We have initiated rapid screening of many of the subsurface microbial isolates obtained from the P24 borehole at the Savannah River Site. To date, we have screened approximately 50% of the isolates from P24. We have optimized our insitu hybridization technique, and have developed a cell blot hybridization technique to screen 96 samples on a single blot. This is much faster than reading 96 individual slides. Preliminary experiments have been carried out which indicate specific nutrients can be used to amplify rRNA only in those organisms capable of metabolizing those nutrients. 1 tab., 2 figs.

7683 (DOE/OR/00033–T459) **Molecular analysis of deep subsurface bacteria.** Jimenez Baez, L.E. Puerto Rico Univ., Rio Piedras (Puerto Rico). Sep 1989. 147p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-76OR00033 ;AC09-76SR00001. Order Number DE92004767. Source: OSTI; NTIS; INIS; GPO Dep.

Deep sediments samples from site C10a, in Appleton, and sites, P24, P28, and P29, at the Savannah River Site (SRS), near Aiken, South Carolina were studied to determine their microbial community composition, DNA homology and mol %G+C. Different geological formations with great variability in hydrogeological parameters were found across the depth profile. Phenotypic identification of deep subsurface bacteria underestimated the bacterial diversity at the three SRS sites, since bacteria with the same phenotype have different DNA composition and less than 70% DNA homology. Total DNA hybridization and mol %G+C analysis of deep sediment bacterial isolates suggested that each formation is comprised of different microbial communities. Depositional environment was more important than site and geological formation on the DNA relatedness between deep subsurface bacteria, since more 70% of bacteria with 20% or more of DNA homology came from the same depositional environments. Based on phenotypic and genotypic tests Pseudomonas spp. and Acinetobacter spp.-like bacteria were identified in 85 million years old sediments. This suggests that these microbial communities might have been adapted during a long period of time to the environmental conditions of the deep subsurface.

5508 Morphology

Refer also to citation(s) 6795, 7685

5509 Pathology

Refer also to citation(s) 6795, 7679, 7744, 7802

5510 Physiological Systems

7684 (DOE/ER/60409–6) **Modulation of lymphopoiesis: Comprehensive progress report, January 1, 1991–July 30, 1991.** Rosse, C. Washington Univ., Seattle, WA (United States). Dept. of Biological Structure. [1991]. 30p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-86ER60409. Order Number DE92004451. Source: OSTI; NTIS; GPO Dep.

During the current project period we have demonstrated correspondence between animal models and in vitro models of modulated lymphopoiesis. Our finding that G-CSF, a growth factor for neutrophil granulocytes, suppresses lymphopoiesis in long term bone marrow cultures (LTBMC) has important implications both for understanding the regulatory mechanisms of hemopoiesis and for clinical use of recombinant growth factors that are beginning to be widely used for the treatment of a variety of diseases. During the present project period we adopted LTBMC systems developed by others for the purposes of our specific aims. Also we developed a novel long term culture system for NK cells. The discovery of a new growth factor, O-CSF, specific for osteoclasts and the establishment of a clonal assay system that provides evidence for a new class of hemopoietic progenitor cells, the osteoclast progenitor, are important contributions. Given the important role T cells play in the immune response and in the regulation of other lymphohemopoietic cell lineages through the lymphokines they secrete, the need for an in vitro system that lends itself to the analysis of T cell maturation and to the testing of factors that may adversely affect T lymphopoiesis cannot be overemphasized. We believe that we can exploit an advantageous set of circumstances that present an excellent opportunity for initiating a focused experimental program for developing such a system. By a systematic and selective analysis of molecular interactions between heterogenous thymic stromal cells and T cell progenitors at different stages of maturation, it will be possible for our program to define the complement of critical cellular interactions on which successive stages of T lymphopoiesis depend. The experiments we propose will lay a rational foundation for the development of a long term culture system for T lymphopoiesis. 24 refs., 7 figs.

7685 (DOE/ER/60656–5) **Cellular morphometry of the bronchi of human and dog lungs: Progress report, April 1, 1991–October 1, 1991.** Robbins, E.S. New York Univ., NY (United States). Dept. of Cell Biology. Sep 1991. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER60656. Order Number DE92003421. Source: OSTI; NTIS; INIS; GPO Dep.

One hundred and forty-seven bronchial samples (generations 3–6) from 66 patients (62 usable; 36 female, 26 male; median age 61) have been dissected by generation from fixed surgical lung specimens obtained after the removal of pathological lesions. In addition, one hundred and fifty-six mongol dog bronchi (generations 2–6) dissected from different lobes of 26 dog lungs have also been similarly prepared. One hundred and twenty-seven human samples have been completely processed for electron microscopy and have yielded 994 electron micrographs of which 655 have been entered into the Computerized Stereological Analysis System (COSAS) and been used for the measurement of the distances of basal and mucous cell nuclei to the epithelial free surface. Similarly 328 micrographs of dog epithelium from 33 bronchial samples have been used to measure the distances of basal and mucous cell nuclei to the epithelial free surface and have been entered into COSAS. Using the COSAS planimetry program, we continue to expand our established data bases which describe the volume density and nuclear numbers per electron micrograph for 5 cell types of the human bronchial epithelial lining of men and women, as well as smokers, non-smokers and ex-smokers and similar parameters for the same 5 epithelial cell types of dog bronchi. Our micrographs of human bronchial epithelium have allowed us to analyze the recent suggestion that the DNA of lymphocytes may be subject to significant damage from Rn progeny while within the lung. Since the last progress report three papers have been submitted for publication. 17 refs., 4 tabs.

7686 (DOE/OR/00033–T453) **Development of a revised mathematical model of the gastrointestinal tract.** Barker, A. Michigan Univ., Ann Arbor, MI (United States). School of Public Health. Jan 1991. 181p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-76OR00033. Order Number DE92004748. Source: OSTI; NTIS; INIS; GPO Dep.

The objectives of this research are as follows. First, to incorporate new biological data into a revised mathematical adult gastrointestinal tract model that includes: ingestion in both liquid and solid forms; consideration of absorption in the stomach, small intestine, ascending colon, transverse colon or not at all; gender and age of the adult; and whether the adult is a smoker or not. Next, to create a computer program in basic language for calculating residence times in each anatomical section of the GI tract for commonly used radionuclides. Also, to compare and contrast the new model with the ICRP 30 GI tract model in terms of physiological concepts, mathematical concepts, and revised residence times for several commonly used radionuclides. Finally, to determine whether the new model is sufficiently better than the current model to warrant its use as a replacement for the Eve model.

5520 Public Health

Refer also to citation(s) 7649

5530 Agriculture and Food Technology

Refer also to citation(s) 7743

7687 (CNIC–00404) **The new peanut germplasm resources produced by gamma and neutron irradiation and their applications.** Qiu Qingshu (Peanut Research Institute of Shandong Province, Laixi (China)); Lu Rongrong; Yu Shanlin; Shen Fuyu; Lu Zhuzhang; Bi Yingna. China Nuclear Information Centre, Beijing, BJ (China). Jun 1990. 10p. (In Chinese). (CSNAS–0031.). Order Number DE92613550. Source: OSTI; NTIS (US Sales Only); INIS.

Three kinds of peanut seeds and plants (eary, mid, and late maturation) including more than ten varieties having different physiological states and at various developing stages were treated by gamma-ray and fast neutrons. The new 226 accessions of valuable germplasm have been obtained. Some of them are rare germplasm resources which have mutants of high lysine, high ratio of oleic/linoleic and high salt tolerance. These mutants are valuable in the genetic field. Through mutaion breeding the extremely early-maturation variety 'Luhua 6' and high yield aeriety 'P12' with stronger peg have been developed. At present they are being planted in the large area of China.

7688 (CNIC–00437) **The preservation of lotus seeds by irradiation technique.** Lan Junming (Hunan Inst. of Atomic Energy Application in Agriculture (China)); Tang Chuandao. China Nuclear Information Centre, Beijing, BJ (China). Aug 1990. 12p. (In Chinese). (CSNAS–0035.). Order Number DE92613564. Source: OSTI; NTIS (US Sales Only); INIS.

The preservation test results of lotus seeds by gamma-ray irradiation technique are introduced. The results showed that the sitophilus, penicillus and aspergillus oryzae caused the great damage of lotus seeds. It was found that the radiation doses of deactivation for the insects and the mould were 0.8 kGy and 5 kGy respectively. The irradiated seeds packaged in the cloth bags and stored in the storehouse were not damaged by the insects and moulds for three years. The measured resutls also showed that the nutrient compositions were not changed and the pathogenic bacteria were not found. The irradiated lotus seeds are healthy and safe to the people.

7689 (IAEA-TECDOC–613, pp. 17-25) **Applications of radionuclides in the study of cellular immune mechanisms in helminthic infections.** Phillips, S.M. (Pennsylvania Univ., Philadelphia, PA (United States). School of Medicine); Perrin, P.J. International Atomic Energy Agency, Vienna (Austria). Jul 1991. (CONF-881150–: IAEA seminar for Asia and the Pacific on nuclear techniques in communicable and parasitic infections, Bombay (India), 21-25 Nov 1988). In *Nuclear and related techniques in the control of communicable diseases: Proceedings of regional seminars held in Bombay, India, 21-25 November 1988 and Belo Horizonte, Brazil, 30 October - 3 November 1989.* 194p. Order Number DE92613626. Source: OSTI; NTIS (US Sales Only); INIS.

Radionuclide techniques have been utilized in a variety of venues to elucidate the cellular basis of immunity and immunopathology. These techniques are powerful tools in the definition of antigens or epitopes relevant to the immune system. Incorporation labelling of living parasites as well as external labelling of secreted or derived products has been accomplished. These labelled antigens have been used as markers for purification, assessment of immunological reactivity, and measurement of the fate and distribution of epitopes. Such techniques have also been used to study the diversity of the immune response and to sequentially assess the stages of immunoreactivity. The nature of the T cell repetoires responsible for resistance or the regulation of pathology has been quantitated. (author). 12 refs, 5 figs.

7690 (IAEA-TECDOC–613, pp. 51-67) **Application of radionuclide techniques in the characterization of antigens for vaccine development against the human malaria parasite Plasmodium falciparum.** Ramasamy, R. (Queensland Inst. of Medical Research, Brisbane (Australia)); Ramasamy, M.S. International Atomic Energy Agency, Vienna (Austria). Jul 1991. (CONF-881150–: IAEA seminar for Asia and the Pacific on nuclear techniques in communicable and parasitic infections, Bombay (India), 21-25 Nov 1988). In *Nuclear and related techniques in the control of communicable diseases: Proceedings of regional seminars held in Bombay, India, 21-25 November 1988 and Belo Horizonte, Brazil, 30 October - 3 November 1989.* 194p. Order Number DE92613626. Source: OSTI; NTIS (US Sales Only); INIS.

The development of molecular vaccines against the human malaria parasite Plasmodium falciparum requires the characterization of putative protective antigens. The characterization and structural analyses of the small amounts of antigens present in the parasite is made possible by the use of radiolabelled amino acids, monosaccharides and lipids. Parasite proliferation assays, used to identify antibodies that inhibit parasite growth in vitro, utilize radiolabelled hypoxanthine. The determination of T cell epitopes is dependent on measuring lymphocyte proliferation with radiolabelled thymidine. Radiolabelled antibodies are routinely used in Western blots and epitope analysis. The use of these techniques is illustrated in the characterization of two new merozoite surface antigens. (author). 40 refs, 11 figs.

7691 (IAEA-TECDOC–613, pp. 33-35) **Recent advances in DNA technology for communicable diseases.** Siqueira, A.M. (Universidade Federal de Minas Gerais, Belo Horizonte (Brazil). Dept. de Bioquimica e Immunologia). International Atomic Energy Agency, Vienna (Austria). Jul 1991. (CONF-8910558–: IAEA seminar for Latin America on nuclear techniques in parasitic and communicable diseases, Belo Horizonte (Brazil), 30 Oct - 3 nov 1989). In *Nuclear and related techniques in the control of communicable diseases: Proceedings of regional seminars held in Bombay, India, 21-25 November 1988 and Belo Horizonte, Brazil, 30 October - 3 November 1989.* 194p. Order Number DE92613626. Source: OSTI; NTIS (US Sales Only); INIS.

Advances in DNA technology have benefitted every area of biological research in the past several years. A wide variety of new techniques are being developed that will enable researchers to address old and unsolved problems. The polymerase-catalyzed chain reaction (PCR) and the exponential replication of recombinant-RNA hybridization probes using the RNA Replicase of the bacteriophage QB are two of these techniques. Both methods offer powerful means of amplifying specific nucleic acid sequences and can render it possible to perform tasks which will be very useful in studies related to communicable diseases. Among such applications is the development of extremely sensitive molecular reagents for diagnosis of infectious agents. (author). 10 refs.

7692 (IAEA-TECDOC–613, pp. 99-105) **Use of immunoradiometric assays employing monoclonal antibodies or synthetic peptides for the study of malaria transmission and immunity in migrant population of endemic areas in the Amazon Basin.** Oliveira Ferreira, J. (Oswaldo Cruz Inst., Rio de Janeiro (Brazil). Dept. of Immunology); Ribeiro, C.D.; Lourenco Oliveira, R. de; Deane, L.M.; Paiva, A.C.M. International Atomic Energy Agency, Vienna (Austria). Jul 1991. (CONF-8910558–: IAEA seminar for Latin America on nuclear techniques in parasitic and communicable diseases, Belo Horizonte (Brazil), 30 Oct - 3 nov 1989). In *Nuclear and related techniques in the control of communicable diseases: Proceedings of regional seminars held in Bombay, India, 21-25 November 1988 and Belo Horizonte, Brazil, 30 October - 3 November 1989.* 194p. Order Number DE92613626. Source: OSTI; NTIS (US Sales Only); INIS.

Immunoradiometric assays (IRMA) and immunofluorence tests were used in combination with entomological techniques to study malaria epidemiology in areas in the Amazon Basin where non-immune migrant individuals have settled in recent years. Anopheles darlingi was found to be the most important vector accounting for 77% of the anophelines positive for sporozoites by the IRMA. The prevalence of anti-sporozoite and anti-blood stage antibodies was low and decreased with time after the last episode of malaria. Anti-sporozoite antibodies did not indicate immune status of the individual but may reflect malaria transmission. (author). 9 refs, 4 tabs.

7693 (IAEA-TECDOC–613, pp. 157-162) **A study of the blood brain barrier and an evaluation of demyelination in tuberculous meningitis.** Samuel, A.M. (Bhabha Atomic Research Centre, Bombay (India). Radiation Medicine Centre); Dhalla, A.S.; Mazarello, T.B. International Atomic Energy Agency, Vienna (Austria). Jul 1991. (CONF-881150–: IAEA seminar for Asia and the Pacific on nuclear techniques in communicable and parasitic infections, Bombay (India), 21-25 Nov 1988). In *Nuclear and related techniques in the control of communicable diseases: Proceedings of regional seminars held in Bombay, India, 21-25 November 1988 and Belo Horizonte, Brazil, 30 October - 3 November 1989.* 194p. Order Number DE92613626. Source: OSTI; NTIS (US Sales Only); INIS.

The blood brain barrier (BBB) plays an important role in the regulation of homeostasis of the CNS. The effect of tuberculous meningitis (TBM) on the BBB was studied using a ratio of serum albumin-CSF albumin levels. During the acute stage of meningitis 80% of the patients had moderate to severe disturbances in the BBB that persisted 1 to 3 months post therapy. Neurological damage was assessed using Myelin Basic Protein (CBP) as marker. Over 62% of patients with TBM had a significantly high level of MBP. (author). 19 refs, 5 tabs.

7694 (IAEA-TECDOC–613, pp. 163-170) **Murine T-lymphocyte activation by mycobacterial antigens.** Hussong, D. (United States Food and Drug Administration, Bethesda, MD (United States). Center for Biologics Evaluation and Review); Malik, A.; Morris, S.; Chaparas, S.D. International Atomic Energy Agency, Vienna (Austria). Jul 1991. (CONF-881150–: IAEA seminar for Asia and the Pacific on nuclear techniques in communicable and parasitic infections, Bombay (India), 21-25 Nov 1988). In *Nuclear and related techniques in the control of communicable diseases: Proceedings of regional seminars held in Bombay, India, 21-25 November 1988 and Belo Horizonte, Brazil, 30 October - 3 November 1989.* 194p. Order Number DE92613626. Source: OSTI; NTIS (US Sales Only); INIS.

There has been renewed interest in the diagnosis of tuberculosis and other mycobacterial infections in the United States. Effective immunity to mycobacterial infections, as well as diagnosis by the skin test, involves T-cells rather than antibodies. Studies currently underway use the new technologies of monoclonal antibodies and recombinant DNA to define better mycobacterial antigens for T-cell activation, in the hope of identifying species specific antigens. Lymph node cells from mice sensitized to Mycobacterium intracellulare and Mycobacterium avium were assayed for activation by mycobacterial fractions, and cell lines and clones were generated. Comparing BALB/c and B10 mice indicated better responses to M. avium sonicate by B10 mice. A recombinant gene product containing a M. intracellulare peptide was assayed with lymph node cells and indicated excellent T-cell stimulation in BALB/c lymph node cells and cell lines. However, assays using B10 T-cell clones have yet to detect responders to the recombinant protein. Future studies using synthetic epitopes produced by recombinant DNA techniques and defined by monoclonal antibodies are necessary for the identification of reactive T-cell epitopes that are potentially species specific. 4 refs, 7 figs, 1 tab.

7695 (IAEA-TECDOC–613, pp. 171-181) **Use of radionuclide tracers in pharmacokinetic studies of antimalarial compounds.** Jamaludin, A. (National Drug Research Centre, Pinang (Malaysia)); Navaratnam, V. International Atomic Energy Agency, Vienna (Austria). Jul 1991. (CONF-881150–: IAEA seminar for Asia and the Pacific on nuclear techniques in communicable and parasitic infections, Bombay (India), 21-25 Nov 1988). In *Nuclear and related techniques in the control of communicable diseases: Proceedings of regional seminars held in Bombay, India, 21-25 November 1988 and Belo Horizonte, Brazil, 30 October - 3 November 1989.* 194p. Order Number DE92613626. Source: OSTI; NTIS (US Sales Only); INIS.

To conduct pharmacokinetic and metabolic studies, there is a need for the development of sensitive analytical methods. The analytical methods frequently used to analyse antimalarials are High Performance Liquid Chromatography, Gas Chromatography and Thin-Layer Chromatography. However, in vivo studies that need more specific and sensitive methods to measure major metabolites present in the blood or urine require the use of ^{14}C- or ^{3}H-labelled compounds. The parent drug may be so extensively biotransformed that the amount of intact drug may be well below the sensitivity limits of the chemical assay methods available. It is therefore crucial for new antimalarials that in vitro biotransformations by microsomal enzyme preparations and/or in vivo studies using labelled compounds be run in parallel with chemical assay developments. In the case of primaquine, extensive metabolic information was obtained when radiolabelled compounds were used in studies of the metabolism of this compound in mammals. The distribution of primaquine in rat tissues was determined by the use of ^{14}C-labelled primaquine diphosphate. Other pharmacokinetic parameters were obtained when HPLC methods were used to measure primaquine in blood. 6 refs, 3 figs, 3 tabs.

7696 (INIS-BR–2848) **Some effects of gamma radiation in Callosobruchus maculatus (Fabr., 1792) (Coleoptera, Bruchidae).** Walder, J.M.M. Sao Paulo Univ., Piracicaba, SP (Brazil). Escola Superior de Agricultura Luiz de Queiroz. 1974 74p. (In Portuguese). Order Number DE92613552. Source: OSTI; NTIS (US Sales Only); INIS.

The effect of gamma irradiation from a Cobalt-60 source on Callosobruchus maculatus (Fabr.) was studied in this work. Experiments showed that at a dose-rate of 9820 ± 300 rad/hour the LD sub(100) of egg embryos was 2,2 krad, of larvae 3 krad and of pupae 22,8 krad. Total sterilization of adults irradiated of the pupal stage was 5 krad. The sterilizing dose of irradiated adults was 8 krad at a calculated dose-rate of 57.630 ± 5000 rad/hour, whereas the LD sub(100) was 330 krad at a dose-rate of 63650 ± 1500 rad/hour. It was further verified that the number of eggs laid decreased with the irradiation dose. Longevity tended by increase in the females and diminish in the males as a result of irradiation. (author).

7697 (INIS-BR–2850) **Comparative study of native and irradiated crotoxin. Biochemical and pharmacological effects.** Nascimento, N. do. Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, SP (Brazil). 1991 69p. (In Portuguese). Order Number DE92613593. Source: OSTI; NTIS (US Sales Only); INIS.

Ionizing radiation is able to detoxify several venoms, including snake venom, without affecting significantly their antigenic and immunogenic properties. In order to elucidate this phenomena, we conceived a comparative biochemical and pharmacological study between native and gamma irradiated (2000Gy) crotoxin, main toxin of south american rattlesnake Crotalus durissus terrificus. Crotoxin was isolated and purified from crude venom by molecular exclusion chromatography, pI precipitation and then irradiated. Immunodiffusion, electrophoresis and gel filtration showed that the molecular integrity was preserved after irradiation with some higher molecular weight aggregate formation and maintenance of its antigenic capacity. The antibodies induced by irradiated toxin had a similar titer to the antibodies induced by native crotoxin; however with higher protective effects in mice. Crotoxin toxicity became 15 times lower after irradiation, as determined by LD sub(50) in mice. Native and irradiated crotoxin biodistribution occurred with a similar general pattern, with renal elimination. In contrast to irradiated crotoxin, the native crotoxin is initially retained in kidneys. A later concentration (2-3hs) occurs in phagocyticmononuclear cells rich organs (liver and spleen) and neural junctions rich organs (muscle and brain). (author).

7698 (INIS-BR–2856) **The influence of gamma radiation rate over the radiosensitivity of five class of insects.** Domarco, R.E. Sao Paulo Univ., Piracicaba, SP (Brazil). Escola Superior de Agricultura Luiz de Queiroz. 1977 76p. (In Portuguese). Order Number DE92613553. Source: OSTI; NTIS (US Sales Only); INIS.

This paper was aimed at studying the influence of gamma rays dose rate over the radiosensitivity of Sitophilus oryzae (L.), S. zeamais Mots., Rhyzopertha dominica (F.), Zabrotes subfasciatus (Boh.) and Ceratitis capitata Wied. From the results obtained it can be observed that: a) When adults of S. oryzae and S. zeamais were irradiated with either very low dose rates (35, 63, 154 and 632 rad/hour) or very high dose rates (59,580 rad/hour) they showed an increase in their life expectancies, which decreased under intermediate dose rates (2,750 and 15,750 rad/hour). With R. dominica, however, there was continued decrease in life expectancy as the dose rate increased. b) There was a higher emergence of larvae of C. capitata when the eggs were irradiated with low dose rates (1.7, 6.8, 10.9 and 43.9 krad/hour) and with high dose rates (1,577 and 3,759 krad/hour), while the intermediate dose rates (131,330 and 654 krad/hour) were more effective towards causing egg mortality. c) When adults of Z. subfasciatus were irradiated with low dose rates (1.6, 6.7 and 10.8 krad/hour) they underwent a small alteration in life expectancy, mainly for the male insects, while higher dose rates (43.3 krad/hour or more) did not have any influence. (author).

7699 (INIS-BR–2860) **Effects of irradiated diet on longevity and prolificity of successive generations of Zabrotes subfasciatus (Boheman, 1833) (Coleoptera, Bruchidae).** Domarco, R.E. Sao Paulo Univ., Piracicaba, SP (Brazil). Escola Superior de Agricultura Luiz de Queiroz. 1981 78p. (In Portuguese). Order Number DE92614950. Source: OSTI; NTIS (US Sales Only); INIS.

The study was done in the laboratory of Entomology of the Centro de Energia Nuclear na Agricultura (CENA), University of Sao Paulo, in Piracicaba, State of Sao Paulo, Brazil. This research was carried out to observe the effect of irradiated beans (Phaseolus vulgaris, (L.), cultivar Rosinha) on the longevity and prolificity of Zabrotes subfasciatus (Boheman, 1833) (Coleoptera, Bruchidae). The first part of the study included the rearing of five generations of Zabrotes subfasciatus which were fed with irradiated beans (0, 10, 20, 100 e 200 krad, with a dose rate of approximately 70 krad/h). The second one consisted of growth of seven generations on irradiated beans (0, 100, 500, 1500 and 3000 krad, with a dose rate of approximately 70 krad/h). The data were obtained through daily countings of insect birth and death rates. It was concluded that irradiation modified the nutritional quality of beans, affecting the development of Zabrotes subfasciatus. This effect was studied through the longevity and prolificity, which were altered as compared with the control, once they were higher for the dosis of 1500 and 3000 krad. (author).

7700 (INIS-BR–2861) **Gamma radiation effects in Sitophilus oryzae (Linne, 1763) (Coleoptera, Curculionidae).** Pacheco, J.M. Sao Paulo Univ., Piracicaba, SP (Brazil). Escola Superior de Agricultura Luiz de Queiroz. 1973 82p. (In Portuguese). Order Number DE92613554. Source: OSTI; NTIS (US Sales Only); INIS.

Lethal effects were studied for the egg, larval and pupal stages as well as sterilization of adults of Sitophilus oryzae (L.) by the application of gamma radiation. Irradiation of pupae with an estimated dosis of 7887 ± 158 rad inhibits adult emergency. Hypotheses have been suggested that the apparent density and (or) nutrient value of food substrates decisively influence the sterilizing dosis for this insect. Thus, in rice and maize which are apparently denser and (or) of higher nutrient value than maccaroni, insects are sterilized by a dosis of 7 krad, while in maccaroni the sterilizing dosis decreases to 5 krad. (author).

7701 (INIS-BR–2875) **Environmental science and phytosanity. Food irradiation. Abstracts 1968-1990.** Centro de Energia Nuclear na Agricultura (CENA), Piracicaba, SP (Brazil). 1990 132p. (In Portuguese). Order Number DE92613565. Source: OSTI; NTIS (US Sales Only); INIS.

This activity report presents the works realized by the Center of Nuclear Energy on Agriculture (CENA) in food irradiation sector. (author).

7702 (INIS-BR–2877(V.1)) **Proceedings of the 13. Brazilian Congress on Entomology; 1. International Symposium of Bicudo from Cotton-plant; 2. Meeting of Cochineal Insect from Fodder Palm; 3. Meeting of Fruit Flies - v.1.** Sociedade Entomologica do Brasil, Porto Alegre, RS (Brazil). 1991 366p. (In Portuguese). (CONF-9101128–: 13. Brazilian Congress on Entomology, Recife (Brazil), 20-25 Jan 1991). Order Number DE92613555. Source: OSTI; NTIS (US Sales Only); INIS.

This congress describes works on entomology, including topics as chemical control; forest, medical and veterinary entomology; taxonomy; studies of fruit flies and others insects and the use of gamma and ultraviolet radiation for pest control and food preservation. (author).

7703 (INIS-BR–2877(V.1), pp. 63) **Fractionation effect of gamma radiation dose from cobalt-60 about the longevity and reproduction of Sitophilus zeamais MOTS., 1855 (Col. Curculionidae) in maize.** Aguilar, J.D.A. (Centro de Energia Nuclear na Agricultura (CENA), Piracicaba, SP (Brazil)); Arthur, V. Sociedade Entomologica do Brasil, Porto Alegre, RS (Brazil). 1991. 366p. (In Portuguese). (CONF-9101128–: 13. Brazilian Congress on Entomology, Recife (Brazil), 20-25 Jan 1991). In *Proceedings of the 13. Brazilian Congress on Entomology; 1. International Symposium of Bicudo from Cotton-plant; 2. Meeting of Cochineal Insect from Fodder Palm; 3. Meeting of Fruit Flies - v.1.* Order Number DE92613555. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. BEETLES/gamma radiation; BEETLES/maize; BEETLES; MAIZE; COBALT 60; REPRODUCTION

7704 (INIS-BR–2877(V.1), pp. 64) **Fractionation effect of gamma radiation dose from cobalt-60 about the longevity and reproduction of Sitophilus oryzae (L., 1763) (Col. Curculionidae) in maize.** Caceres, C. (Centro de Energia Nuclear na Agricultura (CENA), Piracicaba, SP (Brazil)); Arthur, V. Sociedade

Entomologica do Brasil, Porto Alegre, RS (Brazil). 1991. 366p. (In Portuguese). (CONF-9101128–: 13. Brazilian Congress on Entomology, Recife (Brazil), 20-25 Jan 1991). In *Proceedings of the 13. Brazilian Congress on Entomology; 1. International Symposium of Bicudo from Cotton-plant; 2. Meeting of Cochineal Insect from Fodder Palm; 3. Meeting of Fruit Flies - v.1.* Order Number DE92613555. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. BEETLES/gamma radiation; BEETLES/maize; BEETLES; MAIZE; COBALT 60; REPRODUCTION

7705 (INIS-BR–2877(V.1), pp. 89) **Parthenogenetic reproduction in Aleurodicus cocois anacardii (Homoptera, Aleyrodidae).** Arruda, E.C. (Universidade Federal Rural de Pernambuco, Recife, PE (Brazil)); Arruda, G.P.; Goulart, F.M. Sociedade Entomologica do Brasil, Porto Alegre, RS (Brazil). 1991. 366p. (In Portuguese). (CONF-9101128–: 13. Brazilian Congress on Entomology, Recife (Brazil), 20-25 Jan 1991). In *Proceedings of the 13. Brazilian Congress on Entomology; 1. International Symposium of Bicudo from Cotton-plant; 2. Meeting of Cochineal Insect from Fodder Palm; 3. Meeting of Fruit Flies - v.1.* Order Number DE92613555. Source: OSTI; NTIS (US Sales Only); INIS.

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7706 (INIS-BR–2877(V.1), pp. 116) **Temperature and relative air humidity in collect activity of africanized bee (Apis mellifera, L.) in apple orchard.** Jordao Paranhos, B.A. (Centro de Energia Nuclear na Agricultura (CENA), Piracicaba, SP (Brazil)); Walder, J.M.M.; Chaud Neto, J. Sociedade Entomologica do Brasil, Porto Alegre, RS (Brazil). 1991. 366p. (In Portuguese). (CONF-9101128–: 13. Brazilian Congress on Entomology, Recife (Brazil), 20-25 Jan 1991). In *Proceedings of the 13. Brazilian Congress on Entomology; 1. International Symposium of Bicudo from Cotton-plant; 2. Meeting of Cochineal Insect from Fodder Palm; 3. Meeting of Fruit Flies - v.1.* Order Number DE92613555. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. INSECTS/apples; INSECTS/phosphorus 32; HUMIDITY; INSECTS; APPLES; TEMPERATURE DEPENDENCE

7707 (INIS-BR–2877(V.1), pp. 117) **Collect sphere study of africanized bees, Apis mellifera L. 1758 (Hymenoptera: Apidae), in apple orchard, cv. Anna.** Jordao Paranhos, B.A. (Centro de Energia Nuclear na Agricultura (CENA), Piracicaba, SP (Brazil)); Walder, J.M.M.; Chaud Neto, J. Sociedade Entomologica do Brasil, Porto Alegre, RS (Brazil). 1991. 366p. (In Portuguese). (CONF-9101128–: 13. Brazilian Congress on Entomology, Recife (Brazil), 20-25 Jan 1991). In *Proceedings of the 13. Brazilian Congress on Entomology; 1. International Symposium of Bicudo from Cotton-plant; 2. Meeting of Cochineal Insect from Fodder Palm; 3. Meeting of Fruit Flies - v.1.* Order Number DE92613555. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. INSECTS/apples; INSECTS/phosphorus 32; INSECTS; APPLES

7708 (INIS-BR–2877(V.1), pp. 332) **Influence of gamma radiation from cobalt-60 in pupa of Musca domestica L., 1758 (Diptera: Muscidae).** Silva, A.C. (Universidade Metodista, Piracicaba, SP (Brazil)); Itepan, N.M.; Arthur, V.; Dias, M.C.R. Sociedade Entomologica do Brasil, Porto Alegre, RS (Brazil). 1991. 366p. (In Portuguese). (CONF-9101128–: 13. Brazilian Congress on Entomology, Recife (Brazil), 20-25 Jan 1991). In *Proceedings of the 13. Brazilian Congress on Entomology; 1. International Symposium of Bicudo from Cotton-plant; 2. Meeting of Cochineal Insect from Fodder Palm; 3. Meeting of Fruit Flies - v.1.* Order Number DE92613555. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. PUPAE/flies; PUPAE/gamma radiation; PUPAE/lethal radiation dose; COBALT 60; PUPAE; FLIES

7709 (INIS-BR–2877(V.1), pp. 333) **Influence of gamma radiation from cobalt-60 on eggs viability of Anagasta kuehniella (Zeller, 1879).** Silva, A.C. (Universidade Metodista, Piracicaba, SP (Brazil)); Arthur, V.; Walder, J.M.M.; Domarco, R.E. Sociedade Entomologica do Brasil, Porto Alegre, RS (Brazil). 1991. 366p. (In Portuguese). (CONF-9101128–: 13. Brazilian Congress on Entomology, Recife (Brazil), 20-25 Jan 1991). In *Proceedings of the 13. Brazilian Congress on Entomology; 1. International Symposium of Bicudo from Cotton-plant; 2. Meeting of Cochineal Insect from Fodder Palm; 3. Meeting of Fruit Flies - v.1.* Order Number DE92613555. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. MOTHS/eggs; MOTHS/gamma radiation; COBALT 60; MOTHS; EGGS

7710 (INIS-BR–2877(V.2)) **Proceedings of the 13. Brazilian Congress on Entomology; 1. International Symposium of Bicudo from Cotton-plant; 2. Meeting of Cochineal Insect from Fodder Palm; 3. Meeting of Fruit Flies - v. 2.** Sociedade Entomologica do Brasil, Porto Alegre, RS (Brazil). 1991 314p. (In Portuguese). (CONF-9101128–: 13. Brazilian Congress on Entomology, Recife (Brazil), 20-25 Jan 1991). Order Number DE92613561. Source: OSTI; NTIS (US Sales Only); INIS.

This congress describes works on entomology, including topics as chemical control; forest, medical and veterinary entomology; taxonomy; studies of fruit flies and others insects and the use of gamma and ultraviolet radiation for pest control and food preservation. (author).

7711 (INIS-BR–2877(V.2), pp. 618) **Dispersion aspects of Mediterranean fruit fly, Ceratitis capitata (Wied., 1824) (Diptera: Tephritidae) labelled with 32P in citrus, on the presence and absent of mature fruits.** Silva, E.B. da (Centro de Energia Nuclear na Agricultura (CENA), Piracicaba, SP (Brazil)); Walder, J.M.M. Sociedade Entomologica do Brasil, Porto Alegre, RS (Brazil). 1991. 314p. (In Portuguese). (CONF-9101128–: 13. Brazilian Congress on Entomology, Recife (Brazil), 20-25 Jan 1991). In *Proceedings of the 13. Brazilian Congress on Entomology; 1. International Symposium of Bicudo from Cotton-plant; 2. Meeting of Cochineal Insect from Fodder Palm; 3. Meeting of Fruit Flies - v. 2.* Order Number DE92613561. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CERATITIS CAPITATA/gamma radiation; CERATITIS CAPITATA/phosphorus 32; CERATITIS CAPITATA/sterilization; STERILIZATION; CITRUS; COBALT 60

7712 (INIS-BR–2877(V.2), pp. 625) **Influence of gamma radiation from cobalt 60 in Doryctobracon areolatus (Szipligeti, 1911) (Hymenoptera, braconidae) parasiting pupae of Anastrepha obliqua (Mac., 1835) (Diptera, tephritidae).** Vicino, S.R. (Centro de Energia Nuclear na Agricultura (CENA), Piracicaba, SP (Brazil)); Arthur, V.; Silva, A.C. da. Sociedade Entomologica do Brasil, Porto Alegre, RS (Brazil). 1991. 314p. (In Portuguese). (CONF-9101128–: 13. Brazilian Congress on Entomology, Recife (Brazil), 20-25 Jan 1991). In *Proceedings of the 13. Brazilian Congress on Entomology; 1. International Symposium of Bicudo from Cotton-plant; 2. Meeting of Cochineal Insect from Fodder Palm; 3. Meeting of Fruit Flies - v. 2.* Order Number DE92613561. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. INSECTS/gamma radiation; INSECTS/lethal radiation dose; COBALT 60; INSECTS; PUPAE

7713 (INIS-BR–2877(V.2), pp. 626) **Gamma radiation effects over pupae of several ages from Anastrepha fraterculus (Wied., 1830) (Diptera: Tephritidae).** Faria, J.T. da (Ministerio da Agricultura e Reforma Agraria, Sao Paulo, SP (Brazil). Delegacia Federal); Suplicy Filho, N. Sociedade Entomologica do Brasil, Porto Alegre, RS (Brazil). 1991. 314p. (In Portuguese). (CONF-9101128–: 13. Brazilian Congress on Entomology, Recife (Brazil), 20-25 Jan 1991). In *Proceedings of the 13. Brazilian Congress on Entomology; 1. International Symposium of Bicudo from Cotton-plant; 2. Meeting of Cochineal Insect from Fodder Palm; 3. Meeting of Fruit Flies - v. 2.* Order Number DE92613561. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. FRUIT FLIES/gamma radiation; FRUIT FLIES/pupae; PUPAE

7714 (INIS-BR–2877(V.2), pp. 627) **DL sub(50) and DL sub(99,9968) determination of gamma radiation over larvas and eggs of Ceratitis capitata (Wied., 1824) in papaya (Carica papaya L.).** Faria, J.T. da (Ministerio da Agricultura e Reforma Agraria, Sao Paulo, SP (Brazil). Delegacia Federal); Suplicy Filho, N. Sociedade Entomologica do Brasil, Porto Alegre, RS (Brazil).

1991. 314p. (In Portuguese). (CONF-9101128–: 13. Brazilian Congress on Entomology, Recife (Brazil), 20-25 Jan 1991). In *Proceedings of the 13. Brazilian Congress on Entomology; 1. International Symposium of Bicudo from Cotton-plant; 2. Meeting of Cochineal Insect from Fodder Palm; 3. Meeting of Fruit Flies - v. 2.* Order Number DE92613561. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CERATITIS CAPITATA/gamma radiation; CERATITIS CAPITATA/papayas; PAPAYAS; EGGS; LARVAE

7715 (INIS-BR–2877(V.2), pp. 630) **Eggs irradiation of Ceratitis capitata (Wied., 1824) in vitro and in mangoes fruits (Mangifera indica L.).** Raga, A. (Insituto Biologico, Sao Paulo, SP (Brazil)); Sato, M.E.; Suplicy Filho, N.; Amorim, E.O.; Yasuoka, S.T.; Faria, J.T. da. Sociedade Entomologica do Brasil, Porto Alegre, RS (Brazil). 1991. 314p. (In Portuguese). (CONF-9101128–: 13. Brazilian Congress on Entomology, Recife (Brazil), 20-25 Jan 1991). In *Proceedings of the 13. Brazilian Congress on Entomology; 1. International Symposium of Bicudo from Cotton-plant; 2. Meeting of Cochineal Insect from Fodder Palm; 3. Meeting of Fruit Flies - v. 2.* Order Number DE92613561. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CERATITIS CAPITATA/eggs; CERATITIS CAPITATA/gamma radiation; CERATITIS CAPITATA/mangoes; EGGS; MANGOES

7716 (INIS-BR–2877(V.2), pp. 632) **Gamma radiation use in mangoes disinfestation for exporting in relation of Ceratitis capitata, Anastrepha fraterculus and Anastrepha obliqua larvas.** Raga, A. (Instituto Biologico, Sao Paulo, SP (Brazil)); Sato, M.E.; Giordano, R.B.P.; Potenza, M.R.; Suplicy Filho, N.; Szulak, C. Sociedade Entomologica do Brasil, Porto Alegre, RS (Brazil). 1991. 314p. (In Portuguese). (CONF-9101128–: 13. Brazilian Congress on Entomology, Recife (Brazil), 20-25 Jan 1991). In *Proceedings of the 13. Brazilian Congress on Entomology; 1. International Symposium of Bicudo from Cotton-plant; 2. Meeting of Cochineal Insect from Fodder Palm; 3. Meeting of Fruit Flies - v. 2.* Order Number DE92613561. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. FRUIT FLIES/gamma radiation; FRUIT FLIES/larvae; FRUIT FLIES/mangoes; COBALT 60; LARVAE; MANGOES

7717 (INIS-BR–2877(V.2), pp. 633) **Haden mangoes disinfestation infested by Anastrepha fraterculus (Wied., 1830) (Dip. Tephritidae), by gamma radiation.** Arthur, V. (Centro de Energia Nuclear na Agricultura (CENA), Piracicaba, SP (Brazil)); Domarco, R.E.; Walder, J.M.M.; Spoto, M.H.F. Sociedade Entomologica do Brasil, Porto Alegre, RS (Brazil). 1991. 314p. (In Portuguese). (CONF-9101128–: 13. Brazilian Congress on Entomology, Recife (Brazil), 20-25 Jan 1991). In *Proceedings of the 13. Brazilian Congress on Entomology; 1. International Symposium of Bicudo from Cotton-plant; 2. Meeting of Cochineal Insect from Fodder Palm; 3. Meeting of Fruit Flies - v. 2.* Order Number DE92613561. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. MANGOES/fruit flies; MANGOES/gamma radiation; MANGOES/larvae; LETHAL RADIATION DOSE; MANGOES; LARVAE

7718 (INIS-BR–2877(V.2), pp. 634) **Disinfestation of Averrhoa carambola infested by Anastrepha obliqua (Mac., 1831) (Diptera, Tephritidae) by gamma radiation.** Arthur, V. (Centro de Energia Nuclear na Agricultura (CENA), Piracicaba, SP (Brazil)). Sociedade Entomologica do Brasil, Porto Alegre, RS (Brazil). 1991. 314p. (In Portuguese). (CONF-9101128–: 13. Brazilian Congress on Entomology, Recife (Brazil), 20-25 Jan 1991). In *Proceedings of the 13. Brazilian Congress on Entomology; 1. International Symposium of Bicudo from Cotton-plant; 2. Meeting of Cochineal Insect from Fodder Palm; 3. Meeting of Fruit Flies - v. 2.* Order Number DE92613561. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. FRUITS/fruit flies; FRUITS/gamma radiation; FRUITS/larvae; FRUITS; LARVAE; LETHAL RADIATION DOSE

7719 (INIS-GB–388) **Proposals for the Food (Control of Irradiation) Regulations 1990.** Department of Agriculture and Fisheries for Scotland, Edinburgh (United Kingdom). 1990 35p. Order Number DE92615178. Source: OSTI; NTIS (US Sales Only); INIS.

This paper summarizes the interpretation of UK Ministery of Agriculture, Fisheries and Food Proposals for the Food (Control of Irradiation) Regulations 1990. (UK).

7720 (INIS-mf–13047) **Food irradiation newsletter. Vol. 15, no. 2.** Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture, Vienna (Austria). Oct 1991 62p. Order Number DE92614951. Source: OSTI; NTIS (US Sales Only); INIS.

Hard copies are available from Joint FAO/IAEA Div. of Nuclear Techniques in Food and Agriculture.

This newsletter contains brief summaries of three coordinated research meetings held in 1991: irradiation in combination with other processes for improving food quality; application of irradiation technique for food processing in Africa; and food irradiation programme for Middle East and European countries. The first Workshop on Public Information on Food Irradiation is summarized, and a Coordinated Research Programme on Irradiation as a Quarantine Treatment of Mites, Nematodes and Insects other than Fruit Fly is announced. This issue also contains a report on the status of food irradiation in China, and a supplement lists clearances of irradiated foods. Tabs.

7721 (INIS-mf–13048) **Facts about food irradiation: Status and trends.** ICGFI fact series. International Consultative Group on Food Irradiation (ICGFI). Food and Agriculture Organization of the United Nations, Rome (Italy); World Health Organization, Geneva (Switzerland); International Atomic Energy Agency, Vienna (Austria). May 1991 2p. Order Number DE92613572. Source: OSTI; NTIS (US Sales Only); INIS.

This fact sheet introduces the concept of irradiating food to reduce post-harvest losses from infestation, contamination and spoilage, to lower the incidence of foodborne diseases and to assist international trade in food products by offering an alternative to fumigation or some other treatments that may not be acceptable to the importing countries.

7722 (INIS-mf–13049) **Facts about food irradiation: Scientific and technical terms.** ICGFI fact series. International Consultative Group on Food Irradiation (ICGFI). Food and Agriculture Organization of the United Nations, Rome (Italy); World Health Organization, Geneva (Switzerland); International Atomic Energy Agency, Vienna (Austria). May 1991 2p. Order Number DE92613573. Source: OSTI; NTIS (US Sales Only); INIS.

This fact sheet explains the scientific and technical terms used in describing food irradiation processes.

7723 (INIS-mf–13050) **Facts about food irradiation: Food irradiation and radioactivity.** ICGFI fact series. International Consultative Group on Food Irradiation (ICGFI). Food and Agriculture Organization of the United Nations, Rome (Italy); World Health Organization, Geneva (Switzerland); International Atomic Energy Agency, Vienna (Austria). May 1991 2p. Order Number DE92613574. Source: OSTI; NTIS (US Sales Only); INIS.

This fact sheet addresses the issue of whether food irradiation makes food radioactive and explains the difference between "irradiation food" and "radioactive food". 4 refs.

7724 (INIS-mf–13051) **Facts about food irradiation: Chemical changes in irradiated foods.** ICGFI fact series. International Consultative Group on Food Irradiation (ICGFI). Food and Agriculture Organization of the United Nations, Rome (Italy); World Health Organization, Geneva (Switzerland); International Atomic Energy Agency, Vienna (Austria). May 1991 2p. Order Number DE92613575. Source: OSTI; NTIS (US Sales Only); INIS.

This fact sheet addresses the safety of irradiated food. The irradiation process produces very little chemical change in food, and laboratory experiments have shown no harmful effects in animals fed with irradiated milk powder. 3 refs.

7725 (INIS-mf–13052) **Facts about food irradiation: Nutritional quality of irradiated foods.** ICGFI fact series. International Consultative Group on Food Irradiation (ICGFI). Food and Agriculture Organization of the United Nations, Rome (Italy); World Health

Organization, Geneva (Switzerland); International Atomic Energy Agency, Vienna (Austria). May 1991 2p. Order Number DE92613576. Source: OSTI; NTIS (US Sales Only); INIS.

This fact sheet briefly considers the nutritional value of irradiated foods. Micronutrients, especially vitamins, are sensitive to any food processing method, but irradiation does not cause any special nutritional problems in food. 4 refs.

7726 (INIS-mf--13053) **Facts about food irradiation: Genetic studies.** ICGFI fact series. International Consultative Group on Food Irradiation (ICGFI). Food and Agriculture Organization of the United Nations, Rome (Italy); World Health Organization, Geneva (Switzerland); International Atomic Energy Agency, Vienna (Austria). May 1991 4p. Order Number DE92613577. Source: OSTI; NTIS (US Sales Only); INIS.

Results published in the mid-1970s from the National Institute of Nutrition (NIN) in India showed increased numbers of polyploid cells in rats, mice, monkeys and malnourished children fed irradiated wheat products. This fact sheet considers the validity of these results. A large number of independent studies have been subsequently performed, and in none of these have results been obtained that support the NIN findings. The conclusion is that there is no evidence to link the consumption of irradiated food with any mutagenic effect. 3 refs.

7727 (INIS-mf--13054) **Facts about food irradiation: Microbiological safety of irradiated food.** ICGFI fact series. International Consultative Group on Food Irradiation (ICGFI). Food and Agriculture Organization of the United Nations, Rome (Italy); World Health Organization, Geneva (Switzerland); International Atomic Energy Agency, Vienna (Austria). May 1991 4p. Order Number DE92613578. Source: OSTI; NTIS (US Sales Only); INIS.

This fact sheet considers the microbiological safety of irradiated food, with especial reference to Clostridium botulinum. Irradiated food, as food treated by any "sub-sterilizing" process, must be handled, packaged and stored following good manufacturing practices to prevent growth and toxin production of C. botulinum. Food irradiation does not lead to increased microbiological hazards, nor can it be used to save already spoiled foods. 4 refs.

7728 (INIS-mf--13055) **Facts about food irradiation: Irradiation and food safety.** ICGFI fact series. International Consultative Group on Food Irradiation (ICGFI). Food and Agriculture Organization of the United Nations, Rome (Italy); World Health Organization, Geneva (Switzerland); International Atomic Energy Agency, Vienna (Austria). May 1991 2p. Order Number DE92613579. Source: OSTI; NTIS (US Sales Only); INIS.

This fact sheet focusses on the question of whether irradiation can be used to make spoiled food good. No food processing procedures can substitute for good hygienic practices, and good manufacturing practices must be followed in the preparation of food whether or not the food is intended for further processing by irradiation or any other means. 3 refs.

7729 (INIS-mf--13056) **Facts about food irradiation: Irradiation and food additives and residues.** ICGFI fact series. International Consultative Group on Food Irradiation (ICGFI). Food and Agriculture Organization of the United Nations, Rome (Italy); World Health Organization, Geneva (Switzerland); International Atomic Energy Agency, Vienna (Austria). May 1991 2p. Order Number DE92613580. Source: OSTI; NTIS (US Sales Only); INIS.

This fact sheet considers the issue of the irradiation of food containing food additives or pesticide residues. The conclusion is that there is no health hazard posed by radiolytic products of pesticides or food additives. 1 ref.

7730 (INIS-mf--13057) **Facts about food irradiation: Packaging of irradiated foods.** ICGFI fact series. International Consultative Group on Food Irradiation (ICGFI). Food and Agriculture Organization of the United Nations, Rome (Italy); World Health Organization, Geneva (Switzerland); International Atomic Energy Agency, Vienna (Austria). May 1991 2p. Order Number DE92613581. Source: OSTI; NTIS (US Sales Only); INIS.

This fact sheet considers the effects on packaging materials of food irradiation. Extensive research has shown that almost all commonly used food packaging materials toted are suitable for use. Furthermore, many packaging materials are themselves routinely sterilized by irradiation before being used. 2 refs.

7731 (INIS-mf--13059) **Facts about food irradiation: Controlling the process.** ICGFI fact series. International Consultative Group on Food Irradiation (ICGFI). Food and Agriculture Organization of the United Nations, Rome (Italy); World Health Organization, Geneva (Switzerland); International Atomic Energy Agency, Vienna (Austria). May 1991 4p. Order Number DE92614091. Source: OSTI; NTIS (US Sales Only); INIS.

This fact sheet briefly reviews the procedures that exist to control the process of food irradiation. It also summarizes the difficulties in identifying irradiated food, which stem from the fact that irradiation does not physically change the food or cause significant chemical changes in foods. 4 refs.

7732 (INIS-mf--13060) **Facts about food irradiation: Food irradiation costs.** ICGFI fact series. International Consultative Group on Food Irradiation (ICGFI). Food and Agriculture Organization of the United Nations, Rome (Italy); World Health Organization, Geneva (Switzerland); International Atomic Energy Agency, Vienna (Austria). May 1991 2p. Order Number DE92613582. Source: OSTI; NTIS (US Sales Only); INIS.

This fact sheet gives the cost of a typical food irradiation facility (US $1 million to US $3 million) and of the food irradiation process (US $10-15 per tonne for low-dose applications; US $100-250 per tonne for high-dose applications). These treatments also bring consumer benefits in terms of availability, storage life and improved hygiene. 2 refs.

7733 (INIS-mf--13061) **Facts about food irradiation: Irradiated foods and the consumer.** ICGFI fact series. International Consultative Group on Food Irradiation (ICGFI). Food and Agriculture Organization of the United Nations, Rome (Italy); World Health Organization, Geneva (Switzerland); International Atomic Energy Agency, Vienna (Austria). May 1991 4p. Order Number DE92613583. Source: OSTI; NTIS (US Sales Only); INIS.

This fact sheet discusses market testing of irradiate food, consumer response to irradiated products has always been positive, and in some countries commercial quantities of some irradiated food items have been sold on a regular basis. Consumers have shown no reluctance to buy irradiated food products. 4 refs.

7734 (KAERI/RR--976/90) **Application of irradiation techniques to food and foodstuffs.** Kwon, Joong Ho (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Byun, Myung Woo; Kim, Suc Won; Yang, Jae Seung; Cho, Han Ok. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Feb 1991. 97p. (In Korean). Order Number DE92614952. Source: OSTI; NTIS (US Sales Only); INIS.

A preservation study of dried fish, anchovies, has been conducted to determine the effect of gamma irradiation and laminated(nylon/polyethylene) film packaging on microbiological, physicochemical and organoleptic qualities of stored samples under room, refrigeration and freezing temperatures. Irradiation at less than 5 kGy and NY/PE-laminated film packaging are anticipated to be significantly effective for over 10 months in terms of improving the hygienic quality and extending the storage life of boiled-dried anchovies. In a survey participating 700 consumers, respondents preferred irradiated food to chemically-treated one. However, majority of respondents (55.7 %) was ignorant of the fact that the Korean government and international organizations concerned have approved the wholesomeness of irradiated food. Insufficiency of public information and understanding for irradiated food was indicated as a major cause for retardation of commercial utilization of food irradiation technology. In a response concerning perception and acceptance toward irradiated food, there was a significant difference between radiation worker and the general public. (Author).

7735 (KURRI-TR--350, pp. 69-76) **The use of nuclear reactor in radiation biology.** Ujeno, Yowri (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Jun 1991. (In Japanese). (CONF-9102139--: Symposium on 'radiation research in life science', Kumatori (Japan), 26-28 Feb 1991). In *Proceedings of the symposium on 'radiation research in life science': Brain damage* *and heritable damage*. 135p. Order Number DE92713959. Source: OSTI; NTIS (US Sales Only); INIS.

The Kyoto University Reactor (KUR) is widely used not only in biology, but also in applied biology, today. These studies were surveyed in the present paper and the future possibility to use KUR in radiation biology was discussed. The researches on the effects of thermal neutrons on various normal tissues, the biological effects of neutrons except thermal neutrons, especially intermediate neutrons between thermal and high speed neutrons or cold neutrons, the adaptive response of cells to thermal neutron radiation, the application of nuclear reactor-produced radionuclides including ^{195m}Pt to biology, and the mutation in botanical science and so on, should be continued using nuclear reactor. The necessity of nuclear reactor in biology and applied biology is emphasized. (author).

7736 (KURRI-TR-352) **Papers presented at the intensive seminar on 'tree rings'.** Noda, Masato (ed.). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Jun 1991. 61p. (In Japanese). (CONF-9009462-: 4. intensive seminar on 'tree rings', Tomakomai (Japan), 3-5 Sep 1990). Order Number DE92751061. Source: OSTI; NTIS (US Sales Only); INIS.

The fourth study meeting 'Tree growth rings' was held in Tomakomai Experimental Plantation attached to the Department of Agriculture, Hokkaido University, different from what it used to be. Though the attendance and the papers presented were not many because of the distance and the improper timing, it was very delightful that the meeting became an earnest gathering. In this report, seven papers presented at the meeting are collected. (K.I.).

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

Refer also to citation(s) 6459, 6717, 6723, 6796, 7088, 7170, 7466, 7482, 7547, 7557, 7581, 7676, 7685, 7735

7737 (BfS-2/91) **Speeches on the inauguration of the BfS Vice-President, the Manager of the Radiation Hygiene Section and the Manager of the Nuclear Safety Section.** Bundesamt fuer Strahlenschutz, Salzgitter (Germany). Aug 1991. 41p. (In German). Order Number DE92759309. Source: OSTI; NTIS (US Sales Only); INIS.

The speeches by the Federal Minister for the Environment and the gentlemen in charge of the Bundesamt fuer Strahlenschutz provide information on the perceived tasks of the Bundesamt: the principles of radiation protection, implementation of the new ICRP recommendations, the formation of the radiation protection register, cooperation on the amendment of the nuclear law with regard to disposal - terminal storage area Konrad, terminal storage project Gorleben, terminal storage area Moosleben. (HSCH).

7738 (BfS-ISH-151/91) **Usefulness and reliability of available epidemiological study results in assessments of radiation-related risks of cancer. Pt. 4. Radiation-related risk of cancer of the thyroid.** Martignoni, K. (Bundesamt fuer Strahlenschutz, Neuherberg (Germany). Inst. fuer Strahlenhygiene); Elsasser, U. Bundesamt fuer Strahlenschutz, Salzgitter (Germany); Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany). May 1990. 102p. (In German). Contract BMU St.Sch. 960. Order Number DE92750160. Source: OSTI; NTIS (US Sales Only); INIS.

Carcinomas occurring in the thyroid gland as a result of radiation generally affect the papillary and, to a slightly lesser extent, follicular parts of this organ, while the available body of evidence hardly gives any indications of anaplastic and medullary neoplasms. Radiation has, however, mostly been associated with multicentric tumours. Among the survivors of the nuclear assaults on Hiroshima and Nagasaki, there are no known cases of anaplastic carcinomas of the thyroid. The papillary carcinoma, which is the prevailing type of neoplasm after radiation exposure, has less malignant potential than the follicular one and is encountered in all age groups. Malignant carcinomas of the thyroid are predominantly found in the middle and high age groups. It was calculated that high Gy doses and dose efficiencies are associated in children with a risk coefficient of 2.5 in 10^4 person-years. This rate is only half as high for adults. Studies performed on relevant cohorts point to latency periods of at least five years. Individuals exposed to radiation are believed to be at a forty-year or even life-long risk of developing cancer. The cancer risk can best be described on the basis of a linear dose-effect relationship. The mortality rate calculated for cancer of the thyroid amounts to approx. 10% of the morbidity rate. The carcinogenic potential of iodine-131 in the thyroid is only one-third as great as that associated with external radiation of high dose efficiency. (orig./MG).

7739 (CNIC-00408) **Study on the abnormalities in sperm and gene mutation induced by retention of ^{147}Pm in testis.** Zhu Shoupeng (Suzhou Medical Coll., JS (China)); Lun Mingyue; Yang Shuqin. China Nuclear Information Centre, Beijing, BJ (China). May 1990. 7p. (In Chinese). (SMC-0044.). Order Number DE92613543. Source: OSTI; NTIS (US Sales Only); INIS.

The purpose of the present study is to ascertain ^{147}Pm retention in testis and its radiogenotoxicological effects of gene mutation through varying radioactivities of internal exposure. Especially the accumulation of ^{147}Pm in testis induces the dominant lethal, dominant skeletal mutation and abnormalities in sperm. Studies indicated that the cumulative absorption dose in testis increases as the internal exposure of ^{147}Pm increases. The internal exposure of ^{147}Pm can destroy the genetic materials and raise the rates of dominant lethal and dominant mutation of skeletal abnormalities in the offspring. The relationship between the rate of dominant skeletal mutation (B) and accumulated radioactivities of ^{147}Pm (D) in testis can be described by a linear equation that is B 20.68 + 35.48 D. The relationship between abnormalities of the sperm and the cumulative dose from ^{147}Pm in testis can be expressed by the following equation: $S = 10.8705 D^{0.5224} + 3.1768$.

7740 (CNIC-00415) **Investigation and evaluation of total radioactivities and the radioactive nuclides of ^{131}I, $^{134.137}$Cs in the food and environment in Suzhou city.** Fu Rongchu (Suzhou Medical Coll., JS (China)); Wang Huiyu; Lu Ming. China Nuclear Information Centre, Beijing, BJ (China). Sep 1990. 5p. (In Chinese). (SMC-0045.). Order Number DE92613544. Source: OSTI; NTIS (US Sales Only); INIS.

The total radioactivities, ^{131}I and ^{134,137}Cs contents in the food and environmental samples in Suzhou city were investigated. The results of the investigation are as follows: (1) In the food, the total alpha is 0.29≈37 Bq/kg(L), the total beta 0.67≈597 Bq/kg(L), the total ^{131}I and ^{134,137}Cs 0.01≈0.1 Bq/kg(L); (2) In the water, the total alpha is 10^{-2} Bq/L, the total beta 10^{-1} Bq/L, the ^{134,137}Cs is 10^{-4} Bq/L. In the melted snow water, the ^{134,137}Cs is as high as 10^{-2} Bq/L; (3) In the surface air, the total alpha is 10^{-4} Bq/m^3, the total beta 10^{-3} Bq/m^3, the $^{134.137}$Cs is 1.98×10^{-4} Bq/m^3, but this value was as high as 8.3×10^{-3} Bq/m^3 after three weeks of Chernobyl accident. The maximum annual effective dose equivalent to resident (adult) caused by ingesting the food and inhaling the air is 9.27×10^{-7} Sv/a and the collective effective dose equivalent is 0.36 man-Sv/a.

7741 (CNIC-00429) **Placental and lactating transfer of ^{147}Pm in mice.** Tao Feng (Suzhou Medical Coll., JS (China)); Zhu Shoupeng. China Nuclear Information Centre, Beijing, BJ (China). Aug 1990. 6p. (In Chinese). (SMC-0046.). Order Number DE92613545. Source: OSTI; NTIS (US Sales Only); INIS.

The placental and lactating transfer of ^{147}Pm in late pregnant mice and lactating mice as well as the distribution of ^{147}Pm in some organs of mother mice were studied and compared. The pregnant mice and lactating mice had intravenous injection with ^{147}Pm nitrate at the 17th day of gestation and the next day of parturition respectively. The two groups were sacrified at the 1st, 4th, 9th, 14th and 21st day after the injection. The retentions of ^{147}Pm in the liver, right femur, uterus, spleen, placenta, fetal membrane and litter were determined by the method of liquid scintillation. The results showed that the amount of ^{147}Pm in litters of both groups was increasing with the days after injection. In the 1st and 4th day of injection the amount of ^{147}Pm in litters of lactating mice was 20 times higher than those in litters of pregnant mice. The amount of ^{147}Pm in livers and skeletons and the half-retention time of prenant and lactating dams were much greater than those of control group.

7742 (CNIC–00433) **Comparative study of internal contamination of different radiators in skeleton on induction of mutagenic effect in bone marrow cells.** Zhu Shoupeng (Suzhou Medical Coll., JS (China)); Wang Liuyi; Yang Weidong. China Nuclear Information Centre, Beijing, BJ (China). Oct 1990. 9p. (In Chinese). (SMC–0047.). Order Number DE92613546. Source: OSTI; NTIS (US Sales Only); INIS.

The purpose of the present study was to ascertain comparative retention of ^{134}Cs or ^{147}Pm in skeleton on induction of chromosome aberrations and PCE's micronucleus formation in bone marrow cells. Results indicated that after iv signal nuclide ^{134}Cs, through 7 weeks observation, the retention data in skeleton could be well described by an exponential expression. Experiments indicated that the retention value and the absorption dose of ^{147}Pm in skeleton were significantly higher in comparison with ^{134}Cs. Both internal contamination of ^{134}Cs or ^{147}Pm could induce chromosome aberrations and PCE's micronucleus formation in bone marrow cells. Among the type of chromosome aberrations of bone marrow cells induced by ^{134}Cs or ^{147}Pm included gap, chromatid breakage, chromosome breakage and translocation. Moreover, the chromosome aberration rates were elevated when the intake of radioactivity of ^{134}Cs or ^{147}Pm were enlarged. At the same time, chromosome fragment of bone marrow cells also induced by ^{134}Cs or ^{147}Pm only through high radioactive contamination. Studies showed that chromosome translocation was appeared only through high radioactivity of ^{147}Pm contamination. By comparing with ^{1}'4^{7}Pm, however, the induction of chromosome aberrations and PCE's micronucleus formation rates on bone marrow cells induced by ^{134}Cs was quite low.

7743 (CNIC–00440) **Studies on the translocation and distribution characteristics of carbon assimilates in blackberry.** Wang Shuyu (Northeast Agricultural College, Harbin, HL (China)); Liu Hongjia. China Nuclear Information Centre, Beijing, BJ (China). Aug 1990. 20p. (In Chinese). (CSNAS–0036.). Order Number DE92613547. Source: OSTI; NTIS (US Sales Only); INIS.

The translocation and distribution characteristics of carbon assimilates were studied with the method of $^{14}CO_2$ feeding. The results indicated that there were different translocation and distribution characteristics of carbon assimilates among the upper, middle and lower leaves in a shoot during annual cycle. Taking away leaves, sun-shading and drought could raise the exporting ratio of carbon assimilates in the feeding leaves and could change the distributing model of the tree. Most of the carbon assimilates were translocated to basic born branch after sun-shading and drought.

7744 (CONF-901274–2) **On the cells of origin of radiogenic thyroid cancer: New studies based on an old idea.** Clifton, K.H.; Domann, F.E.; Groch, K.M. Wisconsin Univ., Madison, WI (United States). Dept. of Human Oncology. [1990]. 27p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER60507. From International symposium on radiation carcinogenesis in the whole-body system; Tokyo (Japan); 5-6 Dec 1990. Order Number DE92004031. Source: OSTI; NTIS; INIS; GPO Dep.

We have presented evidence that the functional thyroid follicles (follicular units, FU) which are formed in grafts of monodispersed rat thyroid cells, and hence the thyroid tumors which later develop in such grafts, are clonal in origin. Recent studies have been designed to investigate: whether cell number-dependent inhibition of promotion-progression is mediated by remote hormonal feed-back, local cell-cell interactions, or both; the cell population kinetics of the clonogen subpopulation during goitrogenesis and goiter involution; and the effect of prolonged exposure to high levels of TSH (thyrotropin) on the capacity of the clonogens to give rise to functional FU. The results indicate that local cell-cell interactions play an important role in the cell number-dependent suppression of neoplastic promotion-progression. They also show that if sufficient thyroid cells are grafted, the thyroid-pituitary axis can be reestablished in thyroidectomized rats fed normal diets. In such animals given iodine deficient diets, the FU that develop in the thyroid grafts shift their secretory pattern to increase the ratio of T3 (triiodothyronine) to T4 (thyroxine), and thus conserve the available iodine. Finally, the clonogenic subpopulation is conserved during both goitrogenesis and goiter involution. When they are transplanted to thyroidectomized recipients, clonogens from two types of goiters form FU that are morphologically indistinguishable from those that develop in grafts of normal thyroid clonogens. Furthermore, the secretion of T3 and T4 by such grafts is dependent on the grafted clonogen number, and hence FU formation, and not on the total number of thyroid cells transplanted. We conclude that the thyroid clonogens, the presumptive cancer progenitor cells, have many of the characteristics of stem cells.

7745 (DOE/ER/60429–T1) **The molecular basis for uv response of cultured human cells.** Karin, M. California Univ., San Diego, La Jolla, CA (United States). [1991]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract FG03-86ER60429. Order Number DE92003766. Source: OSTI; NTIS; GPO Dep.

During the past year we have analyzed the mechanism by which UV and H_2O_2 increase the activity of AP-1 in HeLa cells. AP-1 is a dimeric protein complex composed of the fos and jun gene products. After UV irradiation of HeLa cells (or exposure to H_2O_2) expression of the c-jun gene rapidly increases at least 50-fold. This induction occurs through the previously identified AP-1 site in the c-jun promoter. This positive autoregulation is mediated by AP-1 complexes that are composed mostly of cJun. cJun is a phosphoprotein that undergoes complex changes in its phosphorylation state following exposure to phorbol esters, growth factors or transforming oncogenes. We show that UV irradiation causes increases in the phosphorylation of cJun. We have been trying to determine the common signal by which DNA damaging agents lead to activation of the UV response. We present evidence that oxidative stress may serve as a signal for AP-1 induction during the UV response. We are also trying to purify and characterize UVIC, a factor secreted from UV damaged cells which protects non-irradiated cells from damage. We have identified UVIC as a 17 kDa polypeptide that retains radioprotective activity after SDS-PAGE and renaturation. We are currently scaling up the isolation and purification process. 4 refs. (MHB)

7746 (DOE/ER/60507–5) **Radiogenic neoplasia in thyroid and mammary clonogens: Progress report, January 1, 1991–December 31, 1991.** Clifton, K.H. Wisconsin Univ., Madison, WI (United States). Dept. of Human Oncology. 31 May 1991. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER60507. Order Number DE92004029. Source: OSTI; NTIS; INIS; GPO Dep.

We have developed rat thyroid and mammary clonogen transplantation systems for the study of radiogenic cancer induction at the target cell level in vivo. The epithelial cell populations of both glands contain small subpopulations of cells which are capable of giving rise to monoclonal glandular structures when transplanted and stimulated with appropriate hormones. During the end of the last grant year and the first half of the current grant year, we have completed analyses and summarized for publication: investigations on the relationship between grafted thyroid cell number and the rapidity and degree of reestablishment of the thyroid-hypothalamicpituitary axis in thyroidectomized rats maintained on a normal diet or an iodine deficient diet; studies of the persistence of, and the differentiation potential and functional characteristics of, the TSH- (thyrotropin-) responsive sub-population of clonogens during goitrogenesis, the plateau-phase of goiter growth, and goiter involution; studies of changes in the size of the clonogen subpopulation during goitrogenesis, goiter involution and the response to goitrogen rechallenge; and the results of the large carcinogenesis experiment on the nature of the grafted thyroid cell number-dependent suppression of promotion/progression to neoplasia in grafts of radiation-initiated thyroid cells. We are testing new techniques for the culture, cytofluorescent analysis and characterization mammary epithelial cells and of clonogens in a parallel project, and plan to apply similar technology to the thyroid epithelial cells and clonogen population. Data from these studies will be used in the design of future carcinogenesis experiments on neoplastic initiation by high and low LET radiations and on cells interactions during the neoplastic process.

7747 (DOE/ER/60914–T1) **Comparative toxicity of strontium-90 and radium-226 in beagle dogs: Progress report of second year, December 16, 1990–December 15, 1991.**

Raabe, O.G.; Culbertson, M.R.; White, R.G.; Spangler, W.L.; Cain, G.R.; Parks, N.J.; Samuels, S.J. California Univ., Davis, CA (United States). Lab. for Energy-Related Health Research. [1991]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract FG03-89ER60914. Order Number DE92003764. Source: OSTI; NTIS; INIS; GPO Dep.

We are completing a 30-year study of the biological effects of ^{90}Sr and ^{226}Ra in the beagle in order to predict the possible long-term hazards to people from chronic exposure to low levels of irradiation. Animals received either radionuclide by several means of administration: (a) continual ingestion of ^{90}Sr, (b) a single intravenous injection of ^{90}Sr, or (c) a series of eight intravenous injections of ^{226}Ra. Although administration of ^{90}Sr and ^{226}Ra ended at 540 days of age, the animals continued to receive chronic, low-level radiation doses from these bone-seeking radionuclides throughout life. This project is the largest single cohort study in beagles of internally deposited radionuclides. It is unique in use of the ingestion route for ^{90}Sr and in exposure that began before birth and continued throughout development to adulthood with uniform labeling of the skeletons with ^{90}Sr. The last of the dogs died in 1986 at age 18.5 years, but we are continuing to investigate the significance of these long-term exposures given at low dose rates with regard to cancer production, physiologic well-being, and shortening of life through the detailed records that were kept and by study of preserved materials. All the data have been successfully accumulated and entered into a main-frame computer data base management system. Current work is exclusively directed at preparing research papers summarizing the results and the associated biostatistical and survival analyses. 15 refs., 1 fig., 4 tabs.

7748 (DOE/ER/61171–T1) **Radiation-induced leukemia: Comparative studies in mouse and man: Annual performance report, June 1, 1991–October 31, 1991.** Haas, M. California Univ., San Diego, CA (United States). [1991]. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract FG03-91ER61171. Order Number DE92004436. Source: OSTI; NTIS; GPO Dep.

We now have a clear understanding of the mechanism by which radiation-induced (T-cell) leukemia occurs. In irradiated mice (radiation-induced thymic leukemia) and in man (acute lymphoblastic T-cell leukemia, T-ALL) the mechanism of leukemogenesis is surprisingly similar. Expressed in the most elementary terms, T-cell leukemia occurs when T-cell differentiation is inhibited by a mutation, and pre-T cells attempt but fail to differentiate in the thymus. Instead of leaving the thymus for the periphery as functional T-cells they continue to proliferate in the thymus. The proliferating pre- (pro-) T-cells constitute the (early) acute T-cell leukemia (A-TCL). This model for the mechanism of T-cell leukemogenesis accounts for all the properties of both murine and human A-TCL. Important support for the model has recently come from work by Ilan Kirsch and others, who have shown that mutations/deletions in the genes SCL (TAL), SIL, and LCK constitute primary events in the development of T-ALL, by inhibiting differentiation of thymic pre- (pro-) T-cells. This mechanism of T-cell leukemogenesis brings several specific questions into focus: How do early A-TCL cells progress to become potently tumorigenic and poorly treatable? Is it feasible to genetically suppress early and/or progressed A-TCL cells? What is the mechanism by which the differentiation-inhibited (leukemic) pre-T cells proliferate? During the first grant year we have worked on aspects of all three questions.

7749 (DOE/EV/00119–264) **Research in Radiobiology: Annual report of Work in Progress in the Internal Irradiation Program.** Miller, S.C.; Buster, D.S. (eds.). Utah Univ., Salt Lake City, UT (United States). 31 Dec 1988. 136p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76EV00119. Order Number DE92004081. Source: OSTI; NTIS; INIS; GPO Dep.

This document contains the tables of contents for the reports published by the University of Utah Radiobiology Laboratory from 1953–1987. Also included is a keyword index for the reports, and references for all books, book and symposia chapters and journal article published by Laboratory staff between 1950 and 1988.

7750 (DOE/EV/10095–T2) **Health effects of low-level radiation in shipyard workers: Final report: [Draft].** Matanoski, G.M. Johns Hopkins Univ., Baltimore, MD (United States). Dept. of Epidemiology. Jun 1991. 437p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC02-79EV10095. Order Number DE92003069. Source: OSTI; NTIS; INIS; GPO Dep.

The Nuclear Shipyard Workers Study (NSWS) was designed to determine whether there is an excess risk of leukemia or other cancers associated with exposure to low levels of gamma radiation. The study compares the mortality experience of shipyard workers who qualified to work in radiation areas to the mortality of similar workers who hold the same types of jobs but who are not authorized to work in radiation areas. The population consists of workers from six government and two private shipyards.

7751 (EUR–13268(V.1)) **Radiation protection programme progress report 1985-89. Volume 1.** Commission of the European Communities, Luxembourg (Luxembourg). 1991. 1115p. Contract B16-A-292-F. Source: OSTI; NTIS (US Sales Only); INIS.

The final report of the 1985-89 radiation protection programme outlines the research work carried out during the whole contractual period under all contracts between the Commission of the European Communities and research groups in the Member States. More than 700 scientists collaborated on this programme. Results of more than 440 projects are reported. They are grouped into six sectors: radiation dosimetry and its interpretation; behaviour and control of radionuclides in the environment; non-stochastic effects of ionizing radiation; radiation carcinogenesis; genetic effects of ionizing radiation; evaluation of radiation risks and optimization of protection. Within the framework programme, the aim of this scientific research is to improve the conditions of life with respect to work and protection of man and his environment and to assure safe production of energy, i.e.: (i) to improve methods necessary to protect workers and the population by updating the scientific basis for appropriate standards; (ii) to prevent and counteract harmful effects of radiation; (iii) to assess radiation risks and provide methods to cope with the consequences of radiation accidents.

7752 (EUR–13268(V.2)) **Radiation protection programme progress report 1985-89. Volume 2.** Commission of the European Communities, Luxembourg (Luxembourg). 1991. 838p. Contract B16-C-187-B. Source: OSTI; NTIS (US Sales Only); INIS.

The final report of the 1985-89 radiation protection programme outlines the research work carried out during the whole contractual period under all contracts between the Commission of the European Communities and research groups in the Member States. More than 700 scientists collaborated on this programme. Results of more than 440 projects are reported. They are grouped into six sectors: radiation dosimetry and its interpretation; behaviour and control of radionuclides in the environment; non-stochastic effects of ionizing radiation; radiation carcinogenesis; genetic effects of ionizing radiation; evaluation of radiation risks and optimization of protection. Within the framework programme, the aim of this scientific research is to improve the conditions of life with respect to work and protection of man and his environment and to assure safe production of energy, i.e.: (i) to improve methods necessary to protect workers and the population by updating the scientific basis for appropriate standards; (ii) to prevent and counteract harmful effects of radiation; (iii) to assess radiation risks and provide methods to cope with the consequences of radiation accidents.

7753 (EUR–13268(V.3)) **Radiation protection programme progress report 1985-89. Volume 3.** Commission of the European Communities, Luxembourg (Luxembourg). 1991. 1457p. Contract B16E-148-NL. Source: OSTI; NTIS (US Sales Only); INIS.

The final report of the 1985-89 radiation protection programme outlines the research work carried out during the whole contractual period under all contracts between the Commission of the European Communities and research groups in the Member States. More than 700 scientists collaborated on this programme. Results of more than 440 projects are reported. They are grouped into six sectors: radiation dosimetry and its interpretation; behaviour and control of radionuclides in the environment; non-stochastic effects of ionizing radiation; radiation carcinogenesis; genetic effects of ionizing radiation; evaluation of radiation risks and optimization of protection. Within the framework programme, the aim of this scientific research is to improve the conditions of life with respect to work and protection of man and his environment and to assure safe production of energy, i.e.: (i) to improve methods necessary to protect workers and the population by updating the scientific basis for appropriate standards; (ii) to prevent and counteract harmful effects of radiation; (iii) to assess radiation risks and provide methods to cope with the consequences of radiation accidents.

7754 (EUR–13387) **Radiation protection research and training programme 1990-91 Catalogue of contracts.** Commission of the European Communities, Luxembourg (Luxembourg). 1991. 333p. Source: OSTI; NTIS (US Sales Only); INIS.

This catalogue contains summaries of contacts included in the 1990-91 radiation protection research and training programme, which is divided into three sectors: (a) human exposure to radiation and radioactivity: (i) measurement of radiation dose and its interpretation, (ii) transfer and behaviour of radionuclides in the environment; (b) consequences of radiation exposure to man; their assessment, prevention and treatment: (i) stochastic effects of radiation, (ii) non-stochastic effects of radiation, (iii) radiation effects on the developing organism; (c) risks and management of radiation exposure: (i) assessment of human exposure and risks, (ii) optimization and management of radiation protection.

7755 (EUR-ICP-CEH–093(S)) **Working group on psychological effects of nuclear accidents, Kiev, USSR, 28 May - 1 June 1990: Summary report.** World Health Organization, Copenhagen (Denmark). Regional Office for Europe. 1990. 8p. (CONF-9005257–: International school on nuclear physics, Kiev (USSR), 28 May - 8 jun 1990). Source: OSTI; NTIS (US Sales Only); INIS.

Also issued in French, German and Russian.

The population in the areas affected by the Chernobyl accident is experiencing serious worries about possible health effects. The level of concern appears to be increasing, and the psychological context of the accident should receive detailed consideration. Surveys conducted by Soviet researchers have shown that anxiety has spread for beyond the population of the more heavily contaminated areas. People's awareness of their health status has increased enormously since the accident, and they now attribute many subjective and objective symptoms to radiation exposure. Medical personnel and lay people should be trained in counselling, to enable them to allay the fears people have.

7756 (GSI–91-17) **Cellular and molecular effects of accelerated heavy ions on cultivated mammalian cells.** Heilmann, J. Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany); Bonn Univ. (Germany). Mathematisch-Naturwissenschaftliche Fakultaet. Jun 1991. 103p. (In German). Order Number DE92750162. Source: OSTI; NTIS (US Sales Only); INIS.

In the study described here the capacity of mammalian cells to recover from irradiation with heavy ions was determined from the survival rates observed following irradiation and incubation during damage repair. While the number of surviving cells was seen to increase considerably during the first four hours after X-irradiation, no such signs of recovery were detectable following exposure to heavy ions. Two experiments even pointed to a drastic loss of cells in the initial hours after exposure. In order to assess the degree of molecular damage, total strand breaks and double strand breaks of the DNA were measured. Taking account also of findings revealed in other studies on the induction of DNA strand breaks, it was found that the efficiency curves for the different particles vary according to LET (range investigated between 300 and 16000 kev./μm), which is an observation also made in connection with other endpoints. Notably, DNA double-strand breaks measured for Ne ions (between 300 and 400 kev./μm) pointed to a relative biological effectiveness of greater than One. The nature of DNA damage inflicted was ascertained on the basis of the ratio between double-strand breaks and single-strand breaks. Like the findings on strand break induction, the dependence of the DSB-SSB ratio on the LET was seen to be largely consistent with intracellular measurements in mammalian DNA and with values determined for virus or phage DNA in solutions containing radical scavengers. This congruence appears to be suggestive of radioprotective effects of the cellular matrix. There was no evidence in confirmation of the theory that the high ionisation densities occurring in the path of heavy ions primarily lead to complex damage. (orig./MG).

7757 (INIS-BR–2855) **Viability in holder of irradiated cells: distinguish between repair and cell multiplication.** Araujo, A.C. de. Universidade do Estado, Rio de Janeiro, RJ (Brazil). Centro Biomedico. 1980 81p. (In Portuguese). Order Number DE92613525. Source: OSTI; NTIS (US Sales Only); INIS.

In experiments in which liquid holding recovery (LHR) was measured, the majority of cellular population is formed by non-viable cells and cell multiplication may be important for LHR expression. In order to distinguish between recuperation of viability (true LHR) and cell multiplication, it was necessary to employ improved plating techniques and a fluctuation test based on Poisson distribution. Our results are an indication that this fluctuation test, used together with the traditional method, is a good tool to distinguish repair from cell multiplication. (author).

7758 (INIS-BR–2857) **Thermal degradation products of saccharides: effect study over Escherichia coli K12S cells.** Oliveira, R.L.B.C. de. Universidade do Estado, Rio de Janeiro, RJ (Brazil). Centro Biomedico. 1980 77p. (In Portuguese). Order Number DE92613526. Source: OSTI; NTIS (US Sales Only); INIS.

The heat sterilization of reducing sugars, in the presence of phosphates, in alkaline pH, promotes caramelization reactions, yielding a serie of degradation products. Among them, aldehyde-like compounds seem to be responsible for the decrease in viability of DNA repair-proficient E.coli cells. A positive interaction between toxic solutions and UV-radiation effects is observed in these cells. The sinergism UV-toxic solutions varies in function of post-irradiation time and is dependent on UV dose, indicating the interference of repair processes in toxicity. The effect of non-reducing sugars on cellular viability is negligible, suggesting that toxic substances generation is linked to the presence of at least a free carbonyl group in sugar structure. All tested reducing sugars, when experimental conditions remained constant, have similarly shaped inactivation kinetics and their effects are equally inhibited by catalase activity, during incubation. (author).

7759 (INIS-BR–2859) **Contribution of radiosensitivity study for Walker 256 tumor in rats. Association of early immunization with action of ionized radiation.** Sakate, A.T.Y. Universidade do Estado, Rio de Janeiro, RJ (Brazil). Centro Biomedico. 1979 88p. (In Portuguese). Order Number DE92613530. Source: OSTI; NTIS (US Sales Only); INIS.

The suspension of tumoral cells from Walker 256 were irradiated with doses of 2.500, 4.500, 5.000, 5.500 and 7.500 rad for determining the attenuation dose. The suspension of inactives tumoral cells were injected in rats for verifying the immunized effects in relation of active Walker tumor. After be certified the growth of tumor, the rats were irradiated with cobalt 60 and was verified the decrease of tumor. (author).

7760 (INIS-BR–2863) **Occupational analysis for the Angra-1 reactor.** Moraes, A. Instituto de Radioprotecao e Dosimetria (IRD), Rio de Janeiro, RJ (Brazil). [1991] 62p. (In Portuguese). Order Number DE92613611. Source: OSTI; NTIS (US Sales Only); INIS.

Due to several modifications which were imposed to its time schedule during construction, the Angra-1 reactor did not enter to the grid in 1982 as it was initially foreseen. These modifications occurred due to an unforeseen scenario that was verified in steam generators (serie D-3, Westinghouse) of power stations with similar configurations which had been installed in other countries such as Ringhals-3 (Sweden), Almaraz-1 (Spain) and McGuine-1 (USA). So, among the main events that occurred in the Angra-1 reactor, which were of interest from the point of view of radiation protection, it could be pointed out the personnel monitoring, and the occupational exposure measurements at different reactor power, during the reactor fueling and during modification and tests performed at the steam generators and at ducts of the primary coolant circuit. (author).

7761 (INIS-BR–2869) **Status of the radiation protection in the nuclear fuel cycle: a summary.** Instituto de Radioprotecao e Dosimetria (IRD), Rio de Janeiro, RJ (Brazil). [1991] 8p. (In Portuguese) Order Number DE92613609. Source: OSTI; NTIS (US Sales Only); INIS.

From 1982 to 1984, 27 inspections of Radiation Protection were carried out in two installations of the nuclear fuel cycle, i.e.: (i) Pocos de Caldas (Minas Gerais) Facility - responsible for the search of ore, mining, beneficiation and production of uranium concentrate, and (ii) Fuel Element Production Facility (Resende, Rio de Janeiro) - responsible for fabrication of fuel elements. This report presents the results obtained during such inspections. (author).

7762 (INIS-BR--2877(V.1), pp. 241) **Persistence in soil of savage lineage and mutants from Beauveria bassiana (BALS.)Vuill., and it pathogenesis over caterpillar of Diatraea saccharalis (F., 1794).** Vilas Boas, A.M. (Planalsucar, Carpina, PE (Brazil)); Andrade, R.M. Sociedade Entomologica do Brasil, Porto Alegre, RS (Brazil). 1991. 366p. (In Portuguese). (CONF-9101128--: 13. Brazilian Congress on Entomology, Recife (Brazil), 20-25 Jan 1991). In *Proceedings of the 13. Brazilian Congress on Entomology; 1. International Symposium of Bicudo from Cotton-plant; 2. Meeting of Cochineal Insect from Fodder Palm; 3. Meeting of Fruit Flies - v.1.* Order Number DE92613555. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. FUNGI/sugar cane; FUNGI/ultraviolet radiation; FUNGI; INSECTS; MUTANTS; PATHOGENESIS

7763 (INIS-BR--2877(V.1), pp. 243) **Cytological characterization and survival of Metarhizium anisopliae (Metsch.) Sorokin, in sugar cane leaf.** Ribeiro, S.M.A. (Pernambuco Univ., Recife, PE (Brazil). Dept. de Micologia); Luna Alves Lima, E.A. Sociedade Entomologica do Brasil, Porto Alegre, RS (Brazil). 1991. 366p. (In Portuguese). (CONF-9101128--: 13. Brazilian Congress on Entomology, Recife (Brazil), 20-25 Jan 1991). In *Proceedings of the 13. Brazilian Congress on Entomology; 1. International Symposium of Bicudo from Cotton-plant; 2. Meeting of Cochineal Insect from Fodder Palm; 3. Meeting of Fruit Flies - v.1.* Order Number DE92613555. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. FUNGI/cytological techniques; FUNGI/reproduction; FUNGI/ultraviolet radiation; FUNGI; REPRODUCTION; SUGAR CANE; VEGETATIVE PROPAGATION

7764 (INIS-BR--2883, pp. 10) **Therapeutic room for iodine therapy medical and operational, maintenance and radiation control.** Rodrigues, E.O. (Hospital dos Servidores do Estado, Rio de Janeiro, RJ (Brazil)); Oliveira, A.P.; Simoes, C.H.S.; Kovac, E.C.; Correa, N.D. Associacao Brasileira de Fisicos em Medicina, Rio de Janeiro, RJ (Brazil). 1990. 61p. (CONF-9010386--: 12. Brazilian Congress on Biomedical Engineering and 5. Latin American Conference on Medical Physics, Ribeirao Preto (Brazil), 7-11 Oct 1990). In *Proceedings of the 5. Latin American Meeting on Medical Physics; 2. Workshop on Medical Physics; 1. Workshop on Medical Physics and Biomedical Engineering.* Order Number DE92613627. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. IODINE 131/therapy; THERAPY/buildings; THERAPY; SAFETY STANDARDS; BUILDINGS

7765 (INIS-BR--2883, pp. 47-48) **Group: medical physic division.** Araujo, A.M.C. de (Instituto de Radioprotecao e Dosimetria (IRD), Rio de Janeiro, RJ (Brazil)). Associacao Brasileira de Fisicos em Medicina, Rio de Janeiro, RJ (Brazil). 1990. 61p. (In Portuguese). (CONF-9010386--: 12. Brazilian Congress on Biomedical Engineering and 5. Latin American Conference on Medical Physics, Ribeirao Preto (Brazil), 7-11 Oct 1990). In *Proceedings of the 5. Latin American Meeting on Medical Physics; 2. Workshop on Medical Physics; 1. Workshop on Medical Physics and Biomedical Engineering.* Order Number DE92613627. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. RADIATION PROTECTION/research programs; BIOMEDICAL RADIOGRAPHY

7766 (INIS-BR--2883, pp. 3) **Difficulties and errors in the irradiation of breast tumors and chest wall.** Feld, D.B. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)); Singer, E. Associacao Brasileira de Fisicos em Medicina, Rio de Janeiro, RJ (Brazil). 1990. 61p. (CONF-9010386--: 12. Brazilian Congress on Biomedical Engineering and 5. Latin American Conference on Medical Physics, Ribeirao Preto (Brazil), 7-11 Oct 1990). In *Proceedings of the 5. Latin American Meeting on Medical Physics; 2. Workshop on Medical Physics; 1. Workshop on Medical Physics and Biomedical Engineering.* Order Number DE92613627. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CHEST/cobalt 60; MAMMARY GLANDS/cobalt 60; CHEST; LINEAR ACCELERATORS; PHANTOMS; RADIATION DOSE DISTRIBUTIONS

7767 (INIS-BR--2883, pp. 22-25) **Nuclear and atomic spectroscopy group. Dosimetry in medical physics.** Rubio, M. (Universidad Nacional de Cordoba (Argentina). Facultad de Matematica, Astronomia y Fisica). Associacao Brasileira de Fisicos em Medicina, Rio de Janeiro, RJ (Brazil). 1990. 61p. (In Spanish). (CONF-9010386--: 12. Brazilian Congress on Biomedical Engineering and 5. Latin American Conference on Medical Physics, Ribeirao Preto (Brazil), 7-11 Oct 1990). In *Proceedings of the 5. Latin American Meeting on Medical Physics; 2. Workshop on Medical Physics; 1. Workshop on Medical Physics and Biomedical Engineering.* Order Number DE92613627. Source: OSTI; NTIS (US Sales Only); INIS.

The main activities of radiation physics on the sector of atomic spectroscopy and x-ray fluorescence analysis in the Faculty of Mathematics, Astronomy and Physics (University of Cordoba, Argentina),are presented, including dosimetric studies in radiodiagnostic: dosimetric determination using Monte Carlo method; distortion effect study on PET image and lasers in medicine. (C.G.C.).

7768 (INIS-BR--2883, pp. 32-36) **Group: radiation dosimetry.** Caldas, L.V.E. (Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, SP (Brazil)). Associacao Brasileira de Fisicos em Medicina, Rio de Janeiro, RJ (Brazil). 1990. 61p. (In Portuguese). (CONF-9010386--: 12. Brazilian Congress on Biomedical Engineering and 5. Latin American Conference on Medical Physics, Ribeirao Preto (Brazil), 7-11 Oct 1990). In *Proceedings of the 5. Latin American Meeting on Medical Physics; 2. Workshop on Medical Physics; 1. Workshop on Medical Physics and Biomedical Engineering.* Order Number DE92613627. Source: OSTI; NTIS (US Sales Only); INIS.

The main activities of the radiation dosimetry group is described, including the calibration of instruments, sources and radioactive solutions and the determination of neutron flux; development, production and market dosimetric materials; development radiation sensor make the control of radiation dose received by IPEN workers; development new techniques for monitoring, etc. (C.G.C.).

7769 (INIS-BR--2883, pp. 46) **Group: atomic spectroscopy.** Mainardi, R.T. (Universidad Nacional de Cordoba (Argentina). Facultad de Matematica, Astronomia y Fisica). Associacao Brasileira de Fisicos em Medicina, Rio de Janeiro, RJ (Brazil). 1990. 61p. (CONF-9010386--: 12. Brazilian Congress on Biomedical Engineering and 5. Latin American Conference on Medical Physics, Ribeirao Preto (Brazil), 7-11 Oct 1990). In *Proceedings of the 5. Latin American Meeting on Medical Physics; 2. Workshop on Medical Physics; 1. Workshop on Medical Physics and Biomedical Engineering.* Order Number DE92613627. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. X-RAY FLUORESCENCE ANALYSIS/research programs; DOSIMETRY; OSTEODENSITOMETRY

7770 (INIS-BR--2883, pp. 49-50) **Dosimetry Laboratory and medical physic group of the Physics Institute from Sao Paulo University.** Watanabe, S. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Blak, A.R.; Robilotta, C.C.; Okuno, E.; Cruz, M.T. da; Matsuoka, M. Associacao Brasileira de Fisicos em Medicina, Rio de Janeiro, RJ (Brazil). 1990. 61p. (In Portuguese). (CONF-9010386--: 12. Brazilian Congress on Biomedical Engineering and 5. Latin American Conference on Medical Physics, Ribeirao Preto (Brazil), 7-11 Oct 1990). In *Proceedings of the 5. Latin American Meeting on Medical Physics; 2. Workshop on Medical Physics; 1. Workshop on Medical Physics and Biomedical Engineering.* Order Number DE92613627. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. DOSIMETRY/research programs; COMPUTERIZED TOMOGRAPHY; DOSIMETRY; IMAGES; MEDICINE; SPECIFICATIONS

7771 (INIS-mf–12961, pp. 110-111) **Cytogenetic studies on black rats,Rattus Rattus, from monazite bearing high background radiation areas of Kerala coast and adjoining regions.** Aravindan, K.V. (Bhabha Atomic Research Centre, Bombay (India). Biology and Agriculture Div.); Mahajan, S.K. Atomic Energy Organization of Iran, Teheran (Iran, Islamic Republic of). Radiation Protection Dept. 1990. 157p. (CONF-9011232–: International conference on high levels of natural radiation, Ramsar (Iran, Islamic Republic of), 3-7 Nov 1990). In *Book of abstracts international conference on high levels of natural radiation Ramsar, Islamic Republic of Iran, 3-7 Nov 1990.* Order Number DE92601158. Source: OSTI; NTIS (US Sales Only); INIS.

Short communication. BACKGROUND RADIATION/genetic radiation effects; RATS/background radiation; BIOLOGICAL RADIATION EFFECTS; BONE MARROW; CHROMATIDS; INDIA; MONAZITES; MOSAICISM; RATS; SHORES

7772 (INIS-mf–13025 vp.) **The biological aspects of plutonium (Preprint no. IT-24).** Singh, N.P. (Utah Univ., Salt Lake City, UT (United States). School of Medicine); Wren, M.E. Department of Atomic Energy, Bombay (India). Board of Research in Nuclear Sciences. Feb 1991. 685p. (CONF-9102132–: International symposium on radiochemistry and radiation chemistry - plutonium 50, Bombay (India), 4-7 Feb 1991). In *International symposium on radiochemistry and radiation chemistry (Plutonium - 50 years) (held at Bombay during February 4-7, 1991): Preprints volume.* Order Number DE92001334. Source: OSTI; NTIS (US Sales Only); INIS.

The biological aspects of plutonium including the metabolic behaviour in man and animals, the biochemical behaviour, and the toxicological aspects are reviewed. The results obtained from the human and animal studies suggest that the majority of plutonium is accumulated in the liver and the skeleton. However, if the exposure is through inhalation and the plutonium inhaled is highly insoluble PuO_2, a large fraction of Pu remains in the lung for a long time. The toxicity studies suggest that the alpha emitting isotopes of Pu produce bone sarcomas, liver cancers (both carcinomas and sarcomas) and peripheral lung tumors. The results also show that ^{239}Pu is 16 to 19 times more efficient in inducing bone sarcomas than is ^{226}Ra. Beagle studies show no increased hematopoietic neoplasea (leukemia). (author). 14 refs.

7773 (INIS-mf–13086) **Dictionnary for radiation safety terminology.** ORB. Obespechenie Radiatsionnoj Bezopasnosti. Sovet Ehkonomicheskoj Vzaimopomoshchi, Moscow (USSR). Postoyannaya Komissiya po Ispol'zovaniyu Atomnoj Ehnergii v Mirnykh Tselyakh. 1980 102p. (In Russian). Order Number DE92614961. Source: OSTI; NTIS (US Sales Only); INIS.

The dictionnary of radiation protection terms has been compiled by CMEA member-country specialists under the auspisious of Scientific-Technical Council for Radiation Protection of the Permanent Commision for Peaceful Atomic Energy Applications as a means for better mutual understanding in collaborative activities. The dictionnary incorporates, along with Russian terms, the corresponding ones in the official languages of CMEA member-countries who participated in its compiling: Bulgarian, Hungarian, German, Spanish, Polish, Roumanian, Czech as well as English. The dictionnary consists of three sections: 1) Ionizing radiation; 2) Ionizing radiation interaction with materials. Ionizing radiation dosimetry; 3) Radiation protection. The first section contains 16 terms, the second - 25, the third - 110. The terms within the section are arranged in sense sequences.

7774 (KAERI/RR–937/90) **The development of NPP operational safety training courses.** Lee, Chang Kun (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Lee, Won Koo; Lee, Byung Suhn. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Dec 1990. 194p. (In Korean). Order Number DE92614972. Source: OSTI; NTIS (US Sales Only); INIS.

The training and retraining courses for the reactor operators conducted at the Nuclear Training Center of Korea Atomic Energy Research Institute are recognized as an important part of securing nuclear safety in Korea. Courses on reactor systems for the KAERI engineers, especially those paticipating in YGN-3 and YGN-4 project are also considered to be very important. A textbook for these courses has been compiled and developed based on the Emergency Operations Procedure for Westinghouse nuclear reactors. This text is intended to be used for simulation exercises making use of the Compact Nuclear Simulator designed by KAERI and Studsvik. The course material in the textbook has also been built into the Compact Nuclear Simulator software in such a way that the students can use it interactively during reactor operation simulations. It will also help the students to be prepared themselves for various malfunctions causing reactor trips by following a set of CRT-displayed procedures. (Author).

7775 (KURRI-TR–350, pp. 1-19) **Topics on children's leukemia around the Sellafield nuclear reprocessing plant.** Okada, Shigefumi (Tokyo Univ. (Japan)). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Jun 1991. (In Japanese). (CONF-9102139–: Symposium on 'radiation research in life science', Kumatori (Japan), 26-28 Feb 1991). In *Proceedings of the symposium on 'radiation research in life science': Brain damage and heritable damage.* 135p. Order Number DE92713959. Source: OSTI; NTIS (US Sales Only); INIS.

Yorkshire TV found a Childhood leukemia cluster in the area around the Sellafield nuclear reprocessing plant and attributed it to radioactivities released from the plant. However, further studies indicated the amount of released radioactivities too small to account for the leukemia cluster. Gardner and his team looked into 52 cases of Leukemia in the Sellafield Area, diagnosed between 1950 and 1985 and compared them with about 1000 healthy 'matched' people, born in the area. Their case-control study indicated that children were seven to eight time more likely to develop leukemia if their fathers had received a total cumulative dose of 100 mSv or more than 10 mSv in the six months before conception. This is the first time that childhood leukemia has been linked to father's radiation exposure. If this happens to be the case, one would need to reconsider the radiation protection guide recommended by ICRP. Because of its great implication, one has to examine carefully whether the Gardner's suggestion of Father's exposure is really the cause for leukemia and whether leukemia clusters will be found around the other plants? The present paper attempted to review and evaluate the Gardner's Effects. (author).

7776 (KURRI-TR–350, pp. 20-27) **Is the excess risk of childhood leukemia at Sellafield consistent with the experiences of A-bomb survivors in Hiroshima and Nagasaki ?.** Yoshimoto, Yasuhiko (Radiation Effects Research Foundation, Hiroshima (Japan)). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Jun 1991. (In Japanese). (CONF-9102139–: Symposium on 'radiation research in life science', Kumatori (Japan), 26-28 Feb 1991). In *Proceedings of the symposium on 'radiation research in life science': Brain damage and heritable damage.* 135p. Order Number DE92713959. Source: OSTI; NTIS (US Sales Only); INIS.

The purpose of this communication is to summarize briefly selected studies relevant to the difference between the apparent pre-conception radiation-associated leukemia risks in the offspring born in the area near the Sellafield plant and to the atomic bomb survivors. Although no doubt exists about the hypothesis that radiation damages the genetic material in reproductive cells, it is important to recognize how small the effect in the first generation would be based on the various genetic endpoints. Generally only a small fraction of leukemia cases are inherited – the proportion among all spontaneous cases does not exceed 10 %. Because there is still uncertainty and controversy about the genetic effects of radiation, the possible complex confounding factors are also briefly mentioned. It is clear that the studies of the atomic bomb survivors are pertinent to the possible genetic effect due to radiation-induced mutations in the spermatogonia and oocytes while the observations in Sellafield are, as suggested by Gardner et al. pertinent to the in post-meiotic stages of spermatogenesis. No significant effect of atomic bomb radiation can be shown on the risk of leukemia as well as other genetic effect endpoints, such as the frequency of mutations associated with specific proteins, cytogenetic abnormalities, survival, and so on. (author).

7777 (KURRI-TR–350, pp. 28-33) **Inheritance of leukemia in humans.** Kamada, Nanao (Hiroshima Univ. (Japan). Research Inst. for Nuclear Medicine and Biology). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Jun 1991. (In Japanese).

(CONF-9102139–: Symposium on 'radiation research in life science', Kumatori (Japan), 26-28 Feb 1991). In *Proceedings of the symposium on 'radiation research in life science': Brain damage and heritable damage.* 135p. Order Number DE92713959. Source: OSTI; NTIS (US Sales Only); INIS.

Since Gardner et al. reported an increased incidence of leukemia among children of workers of a nuclear reactor in Sellafield, UK, there have been a number of discussions on the possibility of increased incidence of leukemia among children born from parents exposed to radiation or chemical agents. In this present paper, apart from the leukemia incidence in children from atomic bomb survivors which was discussed by Dr. Yoshimoto, familial leukemia, i.e., a cluster of leukemia among family members within four genetic relations, was discussed with special reference to the age distribution, type of leukemia and consanguinity. Leukemia in twin and leukemias in individuals with congenital anomalies with or without chromosome abnormalities were also discussed. (author).

7778 (KURRI-TR–350, pp. 34-42) **Will parental exposure to radiation induce tumor in sibling ?.** Watanabe, Hiromitsu (Hiroshima Univ. (Japan). Research Inst. for Nuclear Medicine and Biology); Takahashi, Tadateru; Toyota, Kazuhiro; Ito, Akihiro. Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Jun 1991. (In Japanese). (CONF-9102139–: Symposium on 'radiation research in life science', Kumatori (Japan), 26-28 Feb 1991). In *Proceedings of the symposium on 'radiation research in life science': Brain damage and heritable damage.* 135p. Order Number DE92713959. Source: OSTI; NTIS (US Sales Only); INIS.

There are reports of possible risk of transmission of genetic trait(s) through the germ cell in acquired cancer from parent to sibling. We have confirmed that paternal exposure to ^{252}Cf neutron irradiation in mice induced sperm abnormality leading to dominant lethals and liver tumors at F_1 offspring. On the other hand, C3H male mice have been known to have high incidence of spontaneous hepatic tumors and increased hepatic tumor risk in F_1 offsprings maybe caused by the genetic transmission of the hepatoma-inducible-trait amplified by ^{252}Cf neutron irradiation. The present paper describes that paternal exposure to X-ray or chemicals induces heritable characteristics including anomalies and tumors in some special strains of mice and rats. Some possible mechanisms of transmission of genetic trait(s) are also discussed. (author) 52 refs.

7779 (KURRI-TR–350, pp. 43-56) **Radiosensitivity of mouse germ cells.** Matsuda, Yoichi (National Inst. of Radiological Sciences, Chiba (Japan)); Takeuchi, Toyoko; Maemori, Mamiko; Seki, Naohiko; Tobari, Izuo. Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Jun 1991. (In Japanese). (CONF-9102139–: Symposium on 'radiation research in life science', Kumatori (Japan), 26-28 Feb 1991). In *Proceedings of the symposium on 'radiation research in life science': Brain damage and heritable damage.* 135p. Order Number DE92713959. Source: OSTI; NTIS (US Sales Only); INIS.

To estimate radiosensitivity of mouse germ cells the analysis of chromosome aberrations was performed at diakinesis-metaphase I of spermatocytes and first-cleavage metaphase of one-cell embryos after exposure to radiations at various stages of primary spermatocytes and spermatids. The result provided evidence that there are two major types of DNA damage in X-irradiated sperm : (1) short-lived DNA lesions ; the lesions are subject to repair inhibition by agents added in G_1, and are converted into chromosome-type aberrations during G_1, and (2) long-lived DNA lesions ; the lesions persist until S phase and repair of the lesions is inhibited by caffeine, hydroxyurea and arabinofuranosyl cytosine in G_2. The characteristic of X-ray damage induced in spermiogenic stage and repair mechanism for the damage in the fertilized egg were discussed comparing with the results with two chemicals, methyl methanesulfonate (MMS) and mitomycin C (MMC). (J.P.N.).

7780 (KURRI-TR–350, pp. 57-68) **Radiosensitivity in human sperm chromosomes.** Kamiguchi, Yujiroh (Asahikawa Medical Coll., Hokkaido (Japan)). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Jun 1991. (In Japanese). (CONF-9102139–: Symposium on 'radiation research in life science', Kumatori (Japan), 26-28 Feb 1991). In *Proceedings of the symposium on 'radiation research in life science': Brain damage and heritable damage.* 135p. Order Number DE92713959. Source: OSTI; NTIS (US Sales Only); INIS.

We studied the effects of in vitro irradiation of X-, γ- and β-rays on human sperm chromosomes, using our interspecific in vitro fertilization system between human spermatozoa and zona-free hamster oocytes. Spontaneous incidence of chromosome aberrations in human spermatozoa was also studied. Spontaneous incidence of aneuploid spermatozoa was low (1.4 %). Whereas the incidence of spermatozoa with structural chromosome aberrations was surprisingly high (13.5 %), varying considerably among the donors (3.6 - 20.7 %). This variation has no age-dependent correlation. It may be due to the difference in personal history of mutagen exposure. Many of the structural chromosome aberrations were of breakage type (breaks and fragments). They are considered to take place during the postmeiotic period from the spermatid stage to ejaculation. The in vitro exposure to X-, γ- and β-rays showed similar dose effects in inducing chromosome aberrations. The dose-dependent increases of spermatozoa with radiation-induced structural aberrations were linear. The majority of radiation-induced aberrations were of breakage type and they increased linearly with increase of dosage. The RBE values of X-rays and β-rays to γ-rays were nearly 1. There was no great individual variation among donors in the susceptibility of sperm chromosomes to X-, γ- and β-rays. Human spermatozoa have about 1.5- to 3-fold radiosensitivity of those of common laboratory animals. Human spermatozoa retained a high fertilizing ability even after a high dose irradiation (4.25 Gy), indicating possible transmission of radiation-induced chromosomal lesions to the next generation. (author).

7781 (KURRI-TR–350, pp. 77-88) **What do we learn from the mental retardation induced by prenatal exposure in Hiroshima and Nagasaki ?.** Otake, Masanori (Radiation Effects Research Foundation, Hiroshima (Japan)). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Jun 1991. (In Japanese). (CONF-9102139–: Symposium on 'radiation research in life science', Kumatori (Japan), 26-28 Feb 1991). In *Proceedings of the symposium on 'radiation research in life science': Brain damage and heritable damage.* 135p. Order Number DE92713959. Source: OSTI; NTIS (US Sales Only); INIS.

Significant effects of exposure to ionizing radiation on the developing brain are seen among those individuals prenatally exposed in the 8th through 25th weeks after fertilization. These effects, particularly in the most sensitive period, 8-15 weeks after fertilization, manifest themselves as an increased frequency of severe mental retardation, a diminution in IQ score and in school performance, and an increase in the occurrence of seizures. Of 30 SMR cases, 18(60%) had small heads. About 10% of the individuals with small head sizes observed among the in utero clinical sample were mentally retarded when we exclude two probable nonradiation-related cases of Down's syndrome from the 19 SMR cases exposed 8-15 weeks after fertilization, the 95% lower bound of the threshold based on the new dosimetry system appears to be in the range of 0.12-0.23 Gy. In the 16-25 weeks period, the 95% lower bound of the threshold is 0.21 Gy both with and without inclusion of two probable nonirradiation retarded cases. In a regression analysis of IQ scores and school performance data, a greater linearity is suggested with the new dosimetry (DS86) than with the old (T65DR), but the changes in the mean IQ scores and school performances in the low dose region are similar to the changes emerging in the control group, particularly so with doses under 0.10Gy. (author).

7782 (KURRI-TR–350, pp. 89-94) **Effects of some radiations to the development of the brain.** Satow, Yukio (Hiroshima Univ. (Japan). Research Inst. for Nuclear Medicine and Biology). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Jun 1991. (In Japanese). (CONF-9102139–: Symposium on 'radiation research in life science', Kumatori (Japan), 26-28 Feb 1991). In *Proceedings of the symposium on 'radiation research in life science': Brain damage and heritable damage.* 135p. Order Number DE92713959. Source: OSTI; NTIS (US Sales Only); INIS.

The effects of Cf-252, tritium water (HTO) to the mouse embryonic brain and the threshold to produce experimental microcephaly were examined. The results obtained by Cf-252 and HTO irradiations were compared with those of Co-60 standard gamma-rays or tritium simulator (Cs-137 gamma-rays) respectively for determining the relative biological effects (RBE) for the production of microcephaly. Pregnant mouse were injected intraperitoneally with HTO containing 0.05, 0.1, 0.2 or 0.4 mCi HTO/mouse on day 13 of pregnancy. To obtain accurate RBE values of HTO, pregnant mouse were exposed to Cs-137 gamma-rays by tritium simulator on days 13-18 or pregnancy at exponentially decreasing dose in accordance with body tritium concentration. Cf-252 and Co-60 were irradiated to the mouse on day 13 of pregnancy at the same dose rate. The mouse newborn were sacrificed 12 weeks after birth and the brain weight, the length of transverse of cerebrum, antero-posterior length of cerebrum were measured under the stereo-microscope. The results revealed that the shortening of the transverse, antero-posterior length of the cerebrum were seen in the group given 0.05 mCi HTO/mouse (accumulated doses were about 12.5 cGy) of HTO and same results were seen in the group irradiated with 5 cGy of Cf-252 on day 13 of pregnancy. Comparison between HTO and tritium simulator and between Cf-252 and Co-60 showed the teratogenic effects of RBE to produce the 'stereomicroscopically measured microcephaly' to be greater than 1.5 and to reach approximately 3.2. (author).

7783 (KURRI-TR–350, pp. 95-106) **High vulnerability of the developing brain to ionizing radiation.** Inouye, Minoru (Nagoya Univ. (Japan). Research Inst. of Environmental Medicine). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Jun 1991. (In Japanese). (CONF-9102139–: Symposium on 'radiation research in life science', Kumatori (Japan), 26-28 Feb 1991). In *Proceedings of the symposium on 'radiation research in life science': Brain damage and heritable damage.* 135p. Order Number DE92713959. Source: OSTI; NTIS (US Sales Only); INIS.

The developing mammalian brain is highly susceptible to environmental teratogenic insults, because of its long-lasting sensitive period extending from the beginning of embryonic organogenesis to the postnatal infantile period, the great vulnerability of undifferentiated neural cells to wide range of environmental agents including ionizing radiation, and the lack of further reproductive capacity of neurons. Disturbances in the production of neurons, and their migration to the cerebral and cerebellar cortices, give rise to malformations of the brain, such as an absent corpus callosum, disorganized cortical architecture, abnormal fissuring of the cerebral and cerebellar hemispheres, heterotopic cortical gray matter, ectopic cerebellar granule cells, microcephaly, etc. The critical developmental stage for the induction of histogenetic disorders of the cerebral cortex in humans is 8 weeks of pregnancy and following some weeks. This corresponds to day 13 of pregnancy for mice and day 15 for rats, i.e., the ventricular cells of fetal telencephalon are most susceptible to radiation-induced cell death in this stage of development. The lowest doses of X- and gamma-radiations which induce detectable biological effects in rats and mice are around 0.02 Gy in increasing acute cell death. Reduced brain weight and abnormal dendritic arborization are induced by 0.25 Gy and more. Histological abnormalities are produced by 0.5 Gy and more, and microcephaly and cerebellar malformations are by 1 Gy and more. (author).

7784 (KURRI-TR–350, pp. 107-117) **Neurobehavioral teratogenicity of prenatal ionizing-radiations.** Tamaki, Yoshitaka (Shinshu Univ., Nagano (Japan). Fuculty of Education). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Jun 1991. (In Japanese). (CONF-9102139–: Symposium on 'radiation research in life science', Kumatori (Japan), 26-28 Feb 1991). In *Proceedings of the symposium on 'radiation research in life science': Brain damage and heritable damage.* 135p. Order Number DE92713959. Source: OSTI; NTIS (US Sales Only); INIS.

Prenatal irradiation upon the human embryo may result in both malformations and structural damage or degeneration of the nervous system. Neurobehavioral effects of prenatal irradiation can be also regarded as non-stochastic effects with threshold doses. Since up to now only little is known about the molecular basis of learning, memory and behavior the lowest radiation doses for the neurobehavioral teratogenicity of the non-stochastic effects is fairly obscure. (author).

7785 (KURRI-TR–350, pp. 118-125) **Environmentally-induced teratogenesis in humans and the intrauterine fate of normal and abnormal human conceptuses.** Shiota, Kohei (Kyoto Univ. (Japan). Faculty of Medicine). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Jun 1991. (In Japanese). (CONF-9102139–: Symposium on 'radiation research in life science', Kumatori (Japan), 26-28 Feb 1991). In *Proceedings of the symposium on 'radiation research in life science': Brain damage and heritable damage.* 135p. Order Number DE92713959. Source: OSTI; NTIS (US Sales Only); INIS.

This paper reviews some issues concerning environmentally-induced teratogenesis in humans, including identification of human teratogens by means of human epidemiology and animal testings and the assessment of their teratogenic risk in human embryos. It has been shown that a substantially large proportion of abnormal human conceptuses are eliminated spontaneously at early stages of gestation. The prenatal elimination rate of morphologically and/or cytogenetically abnormal human conceptuses has been estimated to be over 90%, while the corresponding rate for normal conceptuses is 20-25 %. (author).

7786 (LBL–31422) **Future biomedical research at the Bevalac.** Alonso, J.R.; Chu, W.T.; Feinberg, B.; Ludewigt, B.A.; Renner, T.R.; Staples, J.W. Lawrence Berkeley Lab., CA (United States). Oct 1991. 2p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-9107194–1: NIRS international workshop on heavy charged particle therapy and related subjects, Chiba (Japan), 4-5 Jul 1991). Order Number DE92004095. Source: OSTI; NTIS; INIS; GPO Dep.

Short communication. BIOMEDICAL RADIOGRAPHY/ion beams; BIOPHYSICS/ion beams; BEVATRON; HEAVY IONS; BIOPHYSICS

7787 (NEI-SE–91) **The elk and its forage plants.** Johanson, K.J.; Bergstroem, R. Swedish Univ. of Agricultural Sciences, Uppsala (Sweden). Dept. of Radioecology. [1991]. 8p. (In Swedish). Order Number DE92613597. Source: OSTI; NTIS (US Sales Only); INIS.

Reports measurements of radioactive cesium in elk, roedeers and plants. The analysis cover the years 1986 to 1988. Samples have been taken from animals killed by hunting or in traffic accidents and from plants which are the basic food of the animals. The average cesium content in meet from elk was: 1986 760 Bq/kg, 1987 664 Bq/kg and for 1988 it is estimated to be about 800 Bq/kg. (K.A.E.).

7788 (NPL-RSA(EXT)–15) **Comparison of factors given in ICRU Report 23 and IAEA TRS 277 for converting from exposure/air kerma to absorbed dose to water for medium energy X-rays.** Rosser, K.E. National Physical Lab., Teddington (United Kingdom). Feb 1991. 18p. Order Number DE92614986. Source: OSTI; NTIS (US Sales Only); INIS.

New values of the factors required to convert the reading of an ionization chamber calibrated in terms of air kerma (or exposure) to absorbed dose to water for medium energy X-rays were given in a Code of Practice published by the IAEA in 1987. These factors differ by a maximum of 12.5% at 0.15 mm Cu HVL from those given in ICRU Report 23. This paper discusses the difference between the ICRU and IAEA conversion factors and forms the basis of the recommendation of the IPSM low and medium energy X-ray dosimetry working party, that dosimetry in the U.K. should continue to be based on ICRU Report 23 and therefore on the current HPA Code of Practice. (author).

7789 (PNL–7600-Pt.1, pp. 7-8) **Tatum Dome cancer incidence study.** Sever, L.E. Pacific Northwest Lab., Richland, WA (United States). Jun 1991. In *Pacific Northwest Laboratory annual report for 1990 to the DOE Office of Energy Research. Part 1, Biomedical sciences.* 151p. Order Number DE91015807. Source: OSTI; NTIS.

The US Department of Energy (DOE) was asked to study the occurrence of cancers in the area around the Tatum Salt Dome Test Site in Lamar County, Mississippi. A two-phased approach is being employed, and the first phase has been completed. This phase has shown that the numbers of cancer deaths or types of cancers in the area around Tatum Dome are not different than expected. That is, there does not appear to be an excess of cancer deaths or evidence of a cluster of cancers associated with the test site. There are, however, limitations to studying only information on deaths. In cooperation with the Mississippi State Department of Health, a second phase therefore is underway. The essential question to be answered in Phase 2 is this: is there an excess number of cancers, particularly types of cancer known to be associated with radiation exposure, near the Tatum Dome site?

7790 (PNL–7600-Pt.1, pp. 33-38) **National radiobiology archives.** Watson, C.R. Pacific Northwest Lab., Richland, WA (United States). Jun 1991. In *Pacific Northwest Laboratory annual report for 1990 to the DOE Office of Energy Research. Part 1, Biomedical sciences.* 151p. Order Number DE91015807. Source: OSTI; NTIS.

The National Radiobiology Archives is a comprehensive effort to gather, organize, and catalog data, tissues, and documents related to radiobiology studies. This will provide future researchers with materials for analysis by advanced molecular biology techniques and with information for statistical analysis to compare results of these and other studies. The project concentrated initially on three tasks associated with studies of beagle dogs exposed to ionizing radiation at five DOE laboratories: (1) implementing an interlaboratory computerized information system containing a summarized dose-and-effects database with results for each of more than 5,000 life-span-observation dogs, a collection inventory database, and a bibliographic database; (2) establishing a document archives of research materials such as logbooks, clinical notes, radiographic films, and pathologists' observations; and (3) establishing a specimen archives for research materials such as biopsy and necropsy tissue samples or histopathology blocks and slides. The databases were designed and have been populated with records from three laboratories. Tissue specimens and histopathology blocks from more than 1,000 dogs have been received from the University of California at Davis. A collaborative effort was initiated for the analysis of ^{137}Cs studies with Argonne National Laboratory and the Inhalation Toxicology Research Institute.

7791 (PNL–7600-Pt.1, pp. 39-44) **Low-level ^{239}PuO$_2$ life-span studies.** Sanders, C.L. Pacific Northwest Lab., Richland, WA (United States). Jun 1991. In *Pacific Northwest Laboratory annual report for 1990 to the DOE Office of Energy Research. Part 1, Biomedical sciences.* 151p. Order Number DE91015807. Source: OSTI; NTIS.

A total of 3,192 female Wistar, 198 male Wistar, 192 female Long-Evans, and 200 female Fisher-344 rats were either sham exposed to, or given a single inhalation of, ^{239}PuO$_2$. Rats are being examined during their life span for spatial-temporal dose-distribution patterns and for lung tumor formation. Significant life-span shortening was seen only at lung doses >8 Gy. The dose-response curve for all lung tumors continues to be best fitted by a quadratic function and a 'practical' threshold of 1-2 Gy; maximum lung tumor incidence is seen at about 8 Gy. Similar quadratic fits were also seen with predominant individual tumor types, squamous carcinoma and adenocarcinoma. Differences in lung tumor incidences between Fischer-344 and Long-Evans rats may be attributed to a faster lung clearance of PuO$_2$ in Long-Evans rats. Increased cell proliferation of type 2 alveolar epithelium may account for much of the carcinogenicity of inhaled plutonium in the lung and the possible existence of a practical threshold response similar to that seen with nongenotoxic chemicals. The incidence of brain tumors in plutonium-exposed Wistar rats was about twice that seen in sham-control rats for both males and females ($p = 0.09$); the predominant tumor type was astrocytoma.

7792 (PNL–7600-Pt.1, pp. 45-50) **Inhalation hazards to uranium miners.** Cross, F.T. Pacific Northwest Lab., Richland, WA (United States). Jun 1991. In *Pacific Northwest Laboratory annual report for 1990 to the DOE Office of Energy Research. Part 1, Biomedical sciences.* 151p. Order Number DE91015807. Source: OSTI; NTIS.

Using experimental animals, the authors are investigating levels of air contaminants that produce respiratory system disease in radon-exposed populations. Lung cancer incidence and deaths from degenerative lung disease are significantly elevated among uranium miners, but the cause-effect relationships for these diseases are based on inadequate epidemiological data. This project identifies agents or combinations of agents (both chemical and radiological), and their exposure levels, that produce respiratory tract lesions, including respiratory epithelial carcinoma, pneumoconiosis, and emphysema. Histopathological examination was continued on 8,000 Series (radon-, radon-progeny-, and uranium ore-dust-exposed) life-span animals and completed on 11,000 Series (radon-, radon-progeny-, uranium ore-dust-, and cigarette-smoke-exposed) serial-sacrifice animals. Data on 8,000 Series animals continue to show that the risk of lung tumors continues to decrease in proportion to the decrease in cumulative radon-progeny exposure and remains elevated at exposures comparable to those found in houses. Data on 11,000 Series animals continue to suggest that cigarette smoke ameliorates radon-progeny-induced lung tumors; however, adenomatosis is more prevalent and severe in rats exposed to smoke after radon-progeny exposure than before radon-progeny exposure. Finally, the validity of the dosimetric approach for estimating risks of plutonium exposures from radon exposures was examined.

7793 (PNL–7600-Pt.1, pp. 51-54) **Mechanisms of radon injury.** Cross, F.T. Pacific Northwest Lab., Richland, WA (United States). Jun 1991. In *Pacific Northwest Laboratory annual report for 1990 to the DOE Office of Energy Research. Part 1, Biomedical sciences.* 151p. Order Number DE91015807. Source: OSTI; NTIS.

In this project the authors conduct molecular, cellular, and whole-animal research relevant to understanding the mechanisms of radon and radon-progeny injury to the respiratory tract. The work specifically addresses the exposure-rate effect in radon-progeny carcinogenesis; the induction-promotion relationships associated with exposure to radon and cigarette-smoke mixtures; the role of oncogenes in radon-induced cancers; the effects of radon on DNA as well as on DNA repair processes; and the involvement of growth factors and their receptors in radon-induced carcinogenesis. In vitro radon and radon-progeny exposures of adult and fetal rat lung cells were initiated to correlate with data on growth factor and growth factor receptor involvement in radon-exposed rats. The analysis of survival response data on Chinese hamster ovary cells (CHO-C18) exposed to radon and radon progeny in intercalibration experiments continued using a model to calculate dose to the cell nucleus for cells exposed in suspension culture. Southern blot analyses of x-ray- and radon-induced mutations at the CHO-HGPRT locus showed a high percentage of deletion-type events in contrast to a low percentage of deletion-type events in spontaneous mutants. No alterations were seen in spontaneous mutants although to date they comprise about 28% of the mutants from x- and radon-irradiated cells. Initiation-promotion-initiation experiments continued in male SPF Wistar rats exposed to radon and cigarette-smoke mixtures. Biological/statistical modeling of PNL experimental data on radon-induced lung tumors in rats also continued.

7794 (PNL–7600-Pt.1, pp. 55-63) **Dosimetry of radon progeny.** James, A.C. Pacific Northwest Lab., Richland, WA (United States). Jun 1991. In *Pacific Northwest Laboratory annual report for 1990 to the DOE Office of Energy Research. Part 1, Biomedical sciences.* 151p. Order Number DE91015807. Source: OSTI; NTIS.

The purpose of this project is to provide key dosimetric models that are needed to evaluate human cancer risks from exposures to radon and thoron progeny and to relate risk to the conditions of exposure. The research encompasses modeling and experimental studies that are necessary (1) to interpret human exposures to radon and thoron progeny in terms of effective dose to sensitive cells, and (2) to integrate findings of the DOE/OHER Radon Research Program, including the effects observed in experimental animals and the cellular and molecular responses observed in vitro, into a coherent and comprehensive assessment of human cancer risks. The authors report here the development and application of a dosimetric model to evaluate radiation doses to sensitive cells throughout the bronchial epithelium of the human adult, child, and infant, and also the corresponding microdosimetric probabilities of radiation events at the subcellular level. The dosimetric model has been used by a Committee of the National Research Council/National Academy of Sciences to examine the extrapolation of risk estimates developed from studies of underground miners to the general population exposed in the home environment.

7795 (PNL–7600-Pt.1, pp. 71-77) **Growth factors in radiation carcinogenesis.** Leung, F.C. Pacific Northwest Lab., Richland, WA (United States). Jun 1991. In *Pacific Northwest Laboratory annual report for 1990 to the DOE Office of Energy Research. Part 1, Biomedical sciences.* 151p. Order Number DE91015807. Source: OSTI; NTIS.

This research project examines the involvement of growth factors (GF) and their receptors (GFR) in radiation-induced carcinogenesis of the lung in animals. The authors used immunocytochemical assays for detecting GF/GFR in lung tumors from dogs and rats exposed to inhaled radionuclides including $^{239}PuO_2$, $^{238}PuO_2$, $^{239}Pu(NO_3)_4$, and radon progeny. Immunocytochemical analysis of epidermal growth factor (EGF) receptor (EGFR) expression was performed on paraffin-block sections of 51 primary lung tumors from dogs exposed to inhaled plutonium and 6 primary lung tumors from control dogs. Four of six (67%) primary lung tumors from control dogs and 21 of 51 (41%) primary lung tumors from plutonium (Pu-) exposed dogs stained positively. In the Pu-exposed dog lung tumors, EGFR-positive staining was observed in 2 of 5 epidermoid carcinomas, 11 of 19 bronchioloalveolar carcinomas, 5 of 15 papillary adenocarcinomas, and 3 of 11 adenosquamous carcinomas. In the control dog lung tumors, EFGR staining was positive in 2 of 2 bronchioloalveolar carcinomas, 2 of 3 papillary adenocarcinomas, and 0 of 1 adenosquamous carcinoma. EFGR-positive staining was observed in 1 of 16 dog lung tumors at the three lowest exposure levels and in 20 of 35 dog lung tumors at the two highest exposure levels. In radon-induced rat lung tumors, EGF, EGFR, transforming growth factor-alpha (TGF-α), and bombesin were found to be abnormally expressed. The abnormal expressions of these GF/GFR were mainly associated with epidermoid carcinoma of the lung and were not found in other histotypes.

7796 (PNL–7600-Pt.1, pp. 79-84) **Oncogenes in radiation-induced carcinogenesis.** Frazier, M.E.; Stiegler, G.L. Pacific Northwest Lab., Richland, WA (United States). Jun 1991. In *Pacific Northwest Laboratory annual report for 1990 to the DOE Office of Energy Research. Part 1, Biomedical sciences.* 151p. Order Number DE91015807. Source: OSTI; NTIS.

The authors are studying the role of activated oncogenes in radiation-induced carcinogenesis. Lung tumor and leukemic cells have been obtained from studies of life-span dose-effect relationships in experimental animals exposed to either plutonium, inhaled radon progeny, or external whole-body radiation. They have done molecular analysis of the ras oncogene family in selected samples using the polymerase chain reaction (PCR) method and direct DNA sequencing of the amplified gene products. They have identified specific activating ras mutations in about one-half of the samples and are characterizing their frequency and specificity to the particular source of inducing radiation. Ultimately, they will use the accumulated data to describe a pattern of genetic change that might provide a basis for distinguishing damage caused by different forms of radiation and chemical mutagens.

7797 (PNL–7600-Pt.1, pp. 85-89) **Mutation of DNA targets.** Schneider, R.P. Pacific Northwest Lab., Richland, WA (United States). Jun 1991. In *Pacific Northwest Laboratory annual report for 1990 to the DOE Office of Energy Research. Part 1, Biomedical sciences.* 151p. Order Number DE91015807. Source: OSTI; NTIS.

The project is testing the hypothesis that tumor suppressor genes are important targets in radiation carcinogenesis. The authors have prepared specific DNA probes and primers to dog Rb and rat p53 genes to characterize their integrity in preserved tumor tissue from animals exposed to radiation. They have amplified, cloned, and analyzed the sequence of a 534-bp fragment of dog Rb cDNA. Methods and primers were developed for amplification and analysis of the rat p53 gene. Amplification of the p53 gene from rat genomic DNA results in amplification of fragments of the predicted size of a cDNA copy of the gene, suggesting the presence of a processed pseudogene.

7798 (PNL–7600-Pt.1, pp. 97-101) **Genotoxicity of inhaled energy effluents.** Brooks, A.L. Pacific Northwest Lab., Richland, WA (United States). Jun 1991. In *Pacific Northwest Laboratory annual report for 1990 to the DOE Office of Energy Research. Part 1, Biomedical sciences.* 151p. Order Number DE91015807. Source: OSTI; NTIS.

The interaction between cellular and genetic damage induced by low- and high-LET radiation and damage produced by chemicals is being studied. The authors have concentrated their research on metals, organic solvents, and fibers used in the nuclear industry and present at nuclear waste sites. Research on metals has demonstrated a multiplicative interaction between beryllium and x rays for induction of chromosome aberrations. Silicon carbide (SiC) fibers used in space nuclear systems were evaluated in lung epithelial cells (LEC) and Chinese hamster ovary cells (CHO). SiC produced a concentration-related increase in cell killing in both cell types but induced no increase in the frequency of micronuclei in either cell type. The fibers interfered with cytokinesis, causing a significant increase in the frequency of multinucleated giant cells in CHO cells but having little effect on LEC cells. No interaction between damage from gamma rays and that from SiC fibers was demonstrated using micronuclei as an endpoint. Research has begun on the genotoxic responses of cells in culture to organic solvents such as methyl isobutyl ketone (hexone), which was used to reprocess nuclear fuels and is now present in large amounts in nuclear waste sites. Hexone caused a concentration-related increase in cell killing and a small increase in the frequency of micronuclei induced in LEC cells. No interaction between damage from gamma rays and hexone was detected by induction of micronuclei. Expansion of this research in vitro and in vivo will provide a mechanistic foundation on which to define the interaction of radiation and chemicals in production of chromosome and cellular damage. Awareness of these mechanisms flags potential problem areas and allows adequate worker protection both in the nuclear industry and during nuclear waste-site cleanup.

7799 (PNL–7600-Pt.1, pp. 103-107) **Fetal and juvenile radiotoxicity.** Sikov, M.R. Pacific Northwest Lab., Richland, WA (United States). Jun 1991. In *Pacific Northwest Laboratory annual report for 1990 to the DOE Office of Energy Research. Part 1, Biomedical sciences.* 151p. Order Number DE91015807. Source: OSTI; NTIS.

This project is involved with the deposition, dosimetry, and toxicity of radionuclides relative to prenatal or postnatal age. Recent emphasis is directed at performing comparative and predictive analyses, modeling patterns and phenomenological interactions to facilitate extrapolations to man, and investigating teratogenic mechanisms. This information is being used in setting radiological protection standards for pregnant women and for rapidly growing infants and children. The authors have completed evaluations of specimens and data from previous experiments, including dosimetric assessments that demonstrated that radon progeny were restricted in their transfer to the fetus during inhalation exposures of pregnant rats. The dosimetry confirmed predictions that the major dose to the conceptus would come from radon that crossed the placenta and its decay products that 18-hour exposures to 124 WLM (working-level months) per day for 13 days would not be teratogenic. The authors further examined relationships between radionuclide transfer to the embryo/fetus and fractional absorption from gut; metabolites showed greater similarities and toxic materials greater differences. Immunocytochemical studies of alterations of extracellular matrix and cell surfaces by radiation effects on limb development in vitro have demonstrated fibronectin changes that correlate with histological and histochemical changes in cartilage differentiation. Related experiments have provided parallel informational about radiation effects on the processes and roles on intercellular communication during early interactions among blastomeres.

5603 Chemicals Metabolism and Toxicology

Refer also to citation(s) 7679, 7685, 7798

7800 (ANL/CP–74664) **Chronic lung injury risk estimates for urban areas having ozone patterns similar to those in the Northeast.** Absil, M. (Argonne National Lab., IL (United States)); Narducci, P.; Whitfield, R.; Richmond, H.M. Argonne National Lab., IL (United States). [1991]. 14p. Sponsored by Environmental Protection Agency. DOE Contract W-31109-ENG-38. (CONF-911180–1: Specialty conference on tropospheric ozone and the environment, Atlanta, GA (United States), 5-7 Nov 1991). Order Number DE92004718. Source: OSTI; NTIS; GPO Dep.

This paper describes the approach and result of an assessment of health risks associated with long-term exposure to ozone. The health endpoint of interest is the probability of formation of mild lesions in the centriacinar region of the lung among children living in New York City. The risk model incorporates an exposure model and a health model. The exposure model is preliminary results of the probabilistic NAAQS Exposure Model (P-NEM) for ozone, and the health model is the judgments of active researchers about the likelihood of formation of ozone-induced lesions in the human lung. Children and New York City were chosen as the population and city of interest because it is believed that children are more sensitive to ozone than any other group of people, and New York City is more representative of other urban areas than Los Angeles, the other city of which P-NEM exposure results are available. Risk results are presented for ten exposure distributions generated by P-NEM, two air quality scenarios ("as-is" and "attainment"), and two exposure periods (1 and 10 ozone seasons). The results vary across experts, are not very sensitive to variations in P-NEM exposure distributions, are lower for attainment conditions than as-is conditions, and are lower for 1 season of exposure than 10 seasons. Although these results are specific to children living in areas having exposure patterns similar to those found in the Northeast, they are fairly representative of results for outdoor workers in the Northeast and Southern California and for children in Southern California. The reason for this is that many experts believe that children and outdoor workers respond in a similar fashion to the given exposure patterns, or that exposure patterns in the Northeast and Southern California are similar. Some experts held both of these beliefs. These results should help policymakers evaluate alternative national ambient air quality standards for ozone. 4 refs., 9 figs., 3 tabs.

7801 (CONF-9110308-1) **The toxicity of particles from combustion processes.** Henderson, R.F.; Mauderly, J.L. Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM (United States). Inhalation Toxicology Research Inst. [1991]. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract AC04-76EV01013. From International conference on toxicology of combustion processes; Pavia (Italy); 28-30 Oct 1991. Order Number DE92004255. Source: OSTI; NTIS; INIS; GPO Dep.

The pulmonary toxicity of inhaled particles will depend on their size, solubility and inherent toxicity. Many combustion-derived particles, such as soot and fly ash, are of a respirable size and, being poorly soluble, are retained for prolonged periods in the lung. The acute toxicity of fly ash from coal combustion was compared to that of a known toxic particle, alpha-quartz, by exposures of rats to 35 mg/m^3 of each type of particle for 7 hr/day, 5 days/wk for 4 wk. The acute pulmonary toxicity was measured by analysis of bronchoalveolar lavage fluid. One year after the exposures, fibrosis with granulomas was observed in the quartz-exposed rats, while little or no fibrosis developed in the fly-ash-exposed rats. The toxicity of soot from diesel exhaust was determined by chronic (30 mo) exposures of rats, 7 hr/day, 5 days/wk to exhaust containing 0.35, 3.5 or 7.0 mg/m^3 soot. The two higher exposures caused persistent pulmonary inflammation, fibrosis and neoplasmas. Rats exposed to the lowest concentration demonstrated no toxic responses and there was no life shortening caused by any exposure. Ongoing comparative studies indicate that pure carbon black particles cause responses similar to those caused by diesel exhaust, indicating that much of the toxicity induced by the diesel soot results from the presence of the large lung burdens of carbonaceous particles.

7802 (DOE/EV/10277-T2) **Mechanisms of action of heavy metals and asbestos on cultured animal cells: Adaptation, transformation and progression: Final progress report, August 1, 1979–January 31, 1987.** Rubin, H. California Univ., Berkeley, CA (United States). [1991]. 131p. Sponsored by U.S. DOE Energy Research. DOE Contract AS03-79EV10277. Order Number DE92004101. Source: OSTI; NTIS; GPO Dep.

Living organisms are exposed to and affected by a variety of physical and chemical environmental factors. Among these are a number of chemical agents which seriously modify the normal functioning and growth of biological systems. The general purpose of this project was to determine some of the effects of several important chemicals on living cells and to investigate the molecular mechanisms whereby these external agents affected cellular structure, physiology, metabolism and growth. Our focus was on several environmental constituents, including asbestos and the heavy metals cadmium, mercury, lead and nickel, which gave both short term and long term effects on various organisms and consequently are of serious public health concern.

7803 (DOE/OR/00033-T461) **An evaluation of aquatic toxicity data with a population growth model for application to environmental hazard assessment.** Burton, W.D. Tennessee Univ., Knoxville, TN (United States). May 1991. 169p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-76OR00033. Order Number DE92004769. Source: OSTI; NTIS; GPO Dep.

Acute and chronic bioassays with the cladocerans Ceriodaphnia dubia and Daphnia magna were conducted using four chemicals, each having a different mode of action. The chemicals were: cadmium (chloride), pentachlorophenol (PCP), 1-octanol, and 1-naphthyl-N-methylcarbamate (carbaryl). The data obtained from the tests were used to compare species sensitivities, endpoint sensitivities, and the relative toxicities of the chemicals. In the acute bioassays, estimates of the median lethal concentrations (48-h LC_{50}S) were used to compare the species sensitivities. Ceriodaphnia dubia was more sensitive than D. magna to all four chemicals, and carbaryl was the most toxic chemical to both species. The sensitivity of three endpoints (survival, reproduction and the intrinsic rate of natural increase, r) were used to evaluate the chronic toxicity of the four chemicals to C. dubia and D. magna. Survival, reproduction and r all declined with greater concentrations of the chemicals. These effects were evident in both the 7- or 14-d exposures. The lowest observed effect concentration (LOEC) determined from studies with the four chemicals showed that neither survival nor reproduction was consistently the more sensitive endpoint for either C. dubia or D. magna. The LOECs for r were the same for both exposure durations for each species. The data from this study demonstrate that the calculations of r from chronic toxicity data can provide equally sensitive bioassay results for protecting the environment, while eliminating conflicting interpretations of toxicant effects on separate endpoints. Furthermore, statistical decisions drawn from comparisons of the toxicity of exposure concentrations with the controls may not provide the most ecologically meaningful criteria for environmental protection. 103 refs., 16 figs., 15 tabs.

7804 (ETDE-mf-2750197) **Development of a test system for the inspection of the phytotoxicity of gases.** Koennecker, G. Technische Univ. Braunschweig (Germany). Naturwissenschaftliche Fakultaet. 20 Dec 1989 156p. (In German). Order Number DE92750197. Source: OSTI; NTIS (US Sales Only).

On the basis of the Continuous Stirred Tank Reactor (CSTR) design, a standard test system with which the toxic effect of gases on higher plants can be checked was developed. Multiple units of the exposure system can be added to a central air control for fresh-air and off-air blowers. The simple construction guarantees a problem-free reconstruction and an easy handling of the system. The dose/effect experiments were carried out with Phaseolus vulgaris and Zea mays and sulphur dioxide. Effect criteria for the plant reaction were the yield parameters: fresh weight and dry weight; sprout/root ratio; fresh weight/dry weight ratio; transpiration coefficient; sulphur concentration. Three-week application of sulphur dioxide caused in the case of the dwarf french bean a significant reduction of the yield parameters. The exposed maize plants, on the other hand, partly reacted to the gas exposure with a clear stimulation of some of the yield parameters. In the case of most yield parameters, there was a linear relationship between the applied toxic gas concentration and the observed plant reaction. (orig./VHE).

7805 (PNL-7600-Pt.1, pp. 91-95) **Molecular events during tumor initiation.** Springer, D.L. Pacific Northwest Lab., Richland, WA (United States). Jun 1991. In *Pacific Northwest Laboratory annual report for 1990 to the DOE Office of Energy Research. Part 1, Biomedical sciences.* 151p. Order Number DE91015807. Source: OSTI; NTIS.

Many in vitro studies have been conducted with benzo[a]pyrene diol-epoxide (BPDE) binding to DNA; in vivo, however, this binding may be altered by association of numerous proteins with the DNA. The fundamental unit of DNA in chromatin is the nucleosome, where the DNA wraps around a core of histone proteins. At this level, the DNA lies on the surface of the protein core particles, and this association protects the DNA from nucleases. An unanswered question is: Does this close association between DNA and proteins protect the DNA from damage by chemical carcinogens or radiation? Studies with very small molecules such as dimethyl sulfate have indicated unrestricted access to the nucleosomal DNA, whereas larger molecules may bind preferentially to naked DNA over nucleosomal DNA. Because BPDE is a large bulky carcinogen, it may bind differently to chromatin compared to naked DNA. Further, BPDE intercalates into the DNA prior to covalently binding to the exocyclic amino groups of deoxyguanosine or deoxyadenine. This suggests that the influence of BPDE binding on chromatin structure may be critical to tumor initiation and progression. Thus, the purpose of the authors work includes determining: (1) the location and frequency of BPDE adducts to naked versus nucleosomal DNA; (2) the influence of BPDE adducts on nucleosome positioning; and (3) whether these adducts alter the expression of genes.

7806 (PNL-SA-19355) **US Department of Energy participation in the development of emergency response planning guidelines: The program and process.** Munson, L.H.; Holder, B.W. Pacific Northwest Lab., Richland, WA (United States). Oct 1991. 12p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-911043-4: 30. Hanford symposium on health and the environment: current topics in occupational health, Richland, WA (United States), 29 Oct - 1 nov 1991). Order Number DE92004506. Source: OSTI; NTIS; GPO Dep.

Emergency response levels and protective action guides for incidents that could expose the public to an accidental release of radiation have been developed and used for many years. Similar attention, has not been focused on hazards from potential chemical releases. The tragic incident in Bhopal, India, in which over 2000 people died and many suffered irreversible health damage, has heightened concern worldwide about real and potential releases of chemicals. This concern, and the resultant re-evaluation by many companies, has demonstrated a need for similar guidelines for dealing with chemical hazards; such guidance would aid significantly in plant design and community planning. To address the need for reliable, consistent, and well-documented emergency planning guidelines, a program of Emergency Response Planning Guidelines (ERPGs) was established by Organization Resources Counselors, Inc. (ORC). ORC, working through established task forces and the American Industrial Hygiene Association (AIHA), oversees ERPG development. This paper describes the program established for developing and issuing ERPGs and the process within DOE for providing support.

57 HEALTH AND SAFETY

Refer also to citation(s) 6790, 8383

7807 (DOE/OR/00033-T455) **Hard-surface contamination detection exercise.** Kawa, S. Michigan Univ., Ann Arbor, MI (United States). 1991. 200p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-76OR00033. Order Number DE92004750. Source: OSTI; NTIS; GPO Dep.

The purpose of this thesis is to create a practical exercise which demonstrates the techniques used by Health Physicists to detect surface contamination, including both instrumentation and smear survey techniques. By understanding the basic principles of the most commonly found instruments the intent is that a new Health Physics graduate can correctly choose, and apply an instrument to their detection situation. The exercise is also intended to acquaint students with the very basic principles of smear techniques. Smear surveys are probably the most universally applied technique in this industry, however, very little literature exists on the subject. The techniques are usually taught, on-the-job and by demonstration. By their seeing and participating in this presentation, it is intended that Health Physics students can accelerate their first few weeks at their new careers, and enable them to recognize common mistakes. Health Physicists are expected to have knowledge of the basic practices of their profession. This exercise will allow Health Physics students to become familiar with the use of hand-held detection devices and the technique of smear surveys. Adequate measurement and recording of surface contamination information is necessary to: meet licensing requirements; protect the health and safety of the workers; maintain accurate records in the case of litigation or dose reconstruction; and maintain high levels of professional competency. This exercise will assist students in obtaining the skills necessary to adequately measure and record levels of surface contamination. 41 refs., 14 figs., 2 tabs.

7808 (PNL-SA-20116) **Occupational safety and health training in DOE.** Farabaugh, M.J. (Pacific Northwest Lab., Richland, WA (United States)); O'Dell, C. Pacific Northwest Lab., Richland, WA (United States). Nov 1991. 6p. Sponsored by U.S. DOE Environment Safety & Health. DOE Contract AC06-76RL01830. (CONF-9111126-6: 15. annual TRADE (training resources and data exchange) conference, St. Petersburg, FL (United States), 18-20 Nov 1991). Order Number DE92004502. Source: OSTI; NTIS; GPO Dep.

Occupational safety and health (OSH) policies, programs and activities within DOE are changing rapidly. In June 1989, Secretary of Energy Watkins launched his "Ten Point Initiative" charting a new course for the Department of Energy (DOE) toward full accountability in the areas of environment, safety and health. Full compliance with Occupational Safety and Health Administration (OSHA) standards is now mandatory within the Department. Independent "Tiger Teams" are performing safety and health compliance assessments at DOE facilities to identify OSH deficiencies. A recent extensive OSHA audit of DOE OSH programs and related activities has resulted in additional changes in DOE OSH requirements. These changes coupled with those pending in the proposed OSHA Reform Act, have had, and will continue to have, a tremendous impact on the roles and responsibilities each of us has within DOE, particularly in the area of OSH training. This presentation focuses on the specific implications these changes have relating to OSH Training Requirements.

5701 Real Accidents

Refer also to citation(s) 6581, 6705

58 GEOSCIENCES

Refer also to citation(s) 6295, 6300, 6392, 6402, 6423, 6440, 6541, 6542, 6543, 7066, 7147, 7508, 7544, 7570, 7573, 7582, 7595, 7596, 7597, 7632

7809 (CONF-8909163-15) **Structural relations within the Paleozoic basement of the mine mountain block; implications for interpretation of gravity data in Yucca Flat, Nevada Test Site.** Cole, J.C.; Wahl, R.R.; Hudson, M.R. Geological Survey, Denver, CO (United States). [1989]. 26p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AI08-86NV10583. From 5. symposium on containment of underground nuclear explosions; Santa Barbara, CA (United States); 19-21 Sep 1989. Order Number DE92004281. Source: OSTI; NTIS; GPO Dep.

Detailed geological mapping in the Mine Mountain block between Yucca Flat and Mid Valley demonstrates that most of the low-angle fault contacts between various Palezoic rock units are the result of Tertiary near-surface block sliding, contrary to the long-held notion that the principal structural control derives from late Mesozoic thrusting during the Sevier orogeny. When structural and stratigraphic features of the hangingwall rocks above these low-angle faults are compared to similar data for the footwall rocks beneath, no evidence is found for the systematic patterns and three-dimensional relationships that characterize thrusted terranes of the Sevier in southern Nevada. If the exposed relations at Mine Mountain are extrapolated as a general structural model for the Palezoic rocks of the area, then the distribution of rock types in the subsurface is much less predictable than with the Mesozoic thrust model. Disconnected and stratigraphically unrelated sheets of diverse Paleozoic rocks may overlie the Eleana eastward to the Carpetbag fault, and possibly beyond. The traditional interpretation of Yucca Flat gravity data is that local gradients correspond to scarps (elevation discontinuities) in the buried top of the Paleozoic basement.

The conservative approach for containment considerations requires that these scarps be inferred to mark the traces of high-angle faults. The Mine Mountain model, however, allows that lateral gravity gradients may be due to lateral density variations in Paleozoic rocks (resulting from the mid-Tertiary sliding), and may have no tectonic significance for the overlying volcanic and alluvial materials. Model calculations show that realistic assumptions for slide-sheet thickness and density contrast can account for observed gravity gradients for a range of burial depths. 33 refs., 10 figs.

7810 (CONF-8909163–17) **Paleostress investigation near Rainier Mesa, Nevada Test Site.** Minor, S.A. Geological Survey, Denver, CO (United States). [1989]. 26p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AI08-86NV10583. From 5. symposium on containment of underground nuclear explosions; Santa Barbara, CA (United States); 19-21 Sep 1989. Order Number DE92004279. Source: OSTI; NTIS; GPO Dep.

Knowledge of the fault-kinematic and paleostress histories in the Rainier Mesa/Yucca Flat region can be beneficial to containment scientists in understanding the effects of natural faults on containment of nuclear detonations. Fault-slip data were collected from 444 small-displacement (0.1–10 m) faults cutting 16-11 Ma tuffs and tuffaceous sedimentary rocks in nine areas mainly along the south, east, and northeast flanks of Rainier Mesa to investigate the faulting and paleostress history in the region. Two of the faults appear to have been test-reactivated as tension cracks and may have also experienced renewed shear displacement. One to three different stress solutions were computed from data collected in seven of the measurement areas. From cross-cutting relations of faults and faulted stratigraphic units, the relative age of many of the computed stress regimes and associated faults were determined. Using stratigraphic constraints and similarities in stress results, a relative stress- regime and faulting sequence was constructed for the study region. Fracturing observed after nuclear explosions is influenced by the structural arrangement of preexisting faults and joints and by the current regional stress field.

7811 (CONF-8909163–18) **Paleomagnetic evaluation of the Yucca-Frenchman Flexure, southern Nevada.** Hudson, M.R. Geological Survey, Denver, CO (United States). [1989]. 14p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AI08-86NV10583. From 5. symposium on containment of underground nuclear explosions; Santa Barbara, CA (United States); 19-21 Sep 1989. Order Number DE92004278. Source: OSTI; NTIS; GPO Dep.

The eastern margin of the Yucca Flat basin, southern Nevada, is bounded by north-northwest-striking tilted fault blocks of the Halfpint Range that curve as much as 90° clockwise into east-northeast strikes in the French Peak-Massachusetts Mountain (FPMM) area. This pattern of arcuate structures was termed the Yucca Frenchman flexure by previous workers who attributed the arcuate pattern to clockwise drag along a proposed northwest-trending, right-lateral shear zone. The flexure model implies that rocks within the FPMM area have been rotated strongly clockwise about a vertical axis. Paleomagnetic data indicate no systematic vertical-axis rotation in the FPMM area and disprove the flexure model. After tilt correction, declinations of 30 site means obtained from the three ash-flow sheets in the FPMM area are more dispersed, but not systematically different than declinations of 12 site means from the Halfpint Range or declinations of 10 site means from little deformed reference areas to the west (Rainier and Pahute Mesas, Shoshone and northern Yucca Mountains). Paleomagnetic data indicate that structures in the FPMM area initiated with arcuate trends; not as originally straight elements that were rotated by right-lateral drag. The structures must have formed under the influence of locally different orientations and (or) ratios of principal stresses. The French Peak-Massachusetts Mountain area lies in an accommodation zone between domains of predominantly west- and east-tilted Miocene and Pliocene extensional fault blocks to the north and south, respectively. I suggest that local interaction between stress fields associated with fault zones that simultaneously propagated from north and south into the accommodation zone may have been responsible for the arcuate structures in the FPMM area.

7812 (DOE/ER/13667–T4) **Isotopic studies of rare gases in terrestrial samples and natural nucleosynthesis: Progress report.** California Univ., Berkeley, CA (United States). Dept. of Physics. May 1991. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract FG03-87ER13667. Order Number DE92003468. Source: OSTI; NTIS; INIS; GPO Dep.

This project is concerned with research in rare gas mass spectrometry. Using a two-pronged attack, we study fluids using a system (RARGA) designed for fluid analysis in bulk which is sometimes deployed in the field and a laser microprobe mass spectrometer for fluid inclusion studies. In 1991 the RARGA project continued monitoring helium isotope variations associated with renewed seismic activity in Long Valley Caldera and expanded our geothermal data base to include Lassen National Park. An important objective, continuing in 1992, is to understand better the reasons for somewhat elevated ^{3}He/^{4}He ratios in regions where there is no contemporary volcanism which could produce the effect by addition of mantle helium. To this end, 1991 saw continued efforts to understand variations in composition between fluids and associated reservoir rocks and extended the data base to include fluids from the Gulf of Mexico. Our DOE work in calibrating a sensitive laser microprobe mass spectrometer for noble gases in fluid inclusions continues with successful returns particularly in calibrating neutron irradiated samples for tracing halogen ratios. In connection with observations of neutron-produced noble gas nuclides in granites, we have begun comparing measurements with calculations for both thermal and epithermal neutrons. We submitted a third paper on noble gases in diamonds, concentrating on observed effects of ^{4}He, ^{3}He, and fission xenon implantation from nuclear processes in adjacent material in the matrix rock. 16 refs., 1 tab.

7813 (DOE/ER/13796–1) **Geologic spatial analysis: 1988 performance report, August 30, 1987–January 30, 1989.** Thiessen, R.L.; Eliason, J.R. Washington State Univ., Pullman, WA (United States). Dept. of Geology. [1989]. 19p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-87ER13796. Order Number DE92003436. Source: OSTI; NTIS; GPO Dep.

This report describes the development of geologic spatial analysis research which focuses on conducting comprehensive three-dimensional analysis of regions using geologic data sets that can be referenced by latitude, longitude, and elevation/depth. (CBS)

7814 (DOE/ER/13807–T1) **CSDP: Seismology of continental thermal regime: Progress report, June 1, 1988–April 30, 1989.** Aki, K. University of Southern California, Los Angeles, CA (United States). Center for Earth Sciences. Apr 1989. 77p. Sponsored by U.S. DOE Energy Research. DOE Contract FG03-87ER13807. Order Number DE92003394. Source: OSTI; NTIS; GPO Dep.

This is a progress report for the past one year of research (year 2 of 5-year project) under the project titled "CSDP: Seismology of Continental Thermal Regime", in which we proposed to develop seismological interpretation theory and methods applicable to complex structures encountered in continental geothermal areas and apply them to several candidate sites for the Continental Scientific Drilling Project. During the past year, two Ph.D. thesis works were completed under the present project. One is a USC thesis on seismic wave propagation in anisotropic media with application to defining fractures in the earth. The other is a MIT thesis on seismic Q and velocity structure for the magma-hydrothermal system of the Valles Caldera, New Mexico. The P.I. co-organized the first International Workshop on Volcanic Seismology at Capri, Italy in October 1988, and presented the keynote paper on the "state-of-art of volcanic seismology". We presented another paper at the workshop on "Assorted Seismic Signals from Kilauea Volcano, Hawaii. Another international meeting, namely, the Chapman Conference on seismic anisotropy in the earth's crust at Berkeley, California in May 1988, was co-organized by the co-P.I. (P.C.L), and we presented our work on seismic waves in heterogeneous and anisotropic media. Adding the publications and presentations made in the past year to the list for the preceding year, the following table lists 21 papers published, submitted or presented in the past two years of the present project. 65 refs., 334 figs., 1 tab.

7815 (DOE/ER/13807–T2) **CSDP: The seismology of continental thermal regimes: Progress report, May 1, 1989–April 30, 1990.** Aki, K. University of Southern California, Los Angeles, CA (United States). Center for Earth Sciences. May 1990. 44p. Sponsored by U.S. DOE Energy Research. DOE Contract FG03-87ER13807. Order Number DE92003393. Source: OSTI; NTIS; GPO Dep.

This is a progress report for the past one year of research (year 3 of 5-year project) under the project titled "CSDP: Seismology of Continental Thermal Regime", in which we proposed to develop seismological interpretation theory and methods applicable to complex structures encountered in continental geothermal areas and apply them to several candidate sites for the Continental Scientific Drilling Project. The past year has been extremely productive especially in the area of interpretation theory, including the following two major break-throughs. One is the derivation of an integral equation for time-dependent power spectra, which unified all the existing theories on seismic scattering (including the radiative transfer theory for total energy and single and multiple scattering theories based on the ray approach) and offers more complete and economical solutions to the problems of seismic scattering and attenuation. The other is the new formula for synthetic seismograms for layered media with irregular interfaces, combining the T-matrix method for an arbitrary shaped inclusion and the method of global generalized reflection/transmission coefficients for layered media. Both breakthroughs will enable us to deal with seismic observations in complex earth structures more efficiently and accurately. In the area of experimental studies, we discovered seismic guided waves trapped in the San Andreas fault near Parkfield, California. 54 refs., 14 figs.

7816 (DOE/ER/13807–T3) **CSDP: The seismology of continental thermal regimes: Progress report, May 1, 1990–April 30, 1991.** Aki, K. University of Southern California, Los Angeles, CA (United States). Center for Earth Sciences. May 1991. 46p. Sponsored by U.S. DOE Energy Research. DOE Contract FG03-87ER13807. Order Number DE92003392. Source: OSTI; NTIS; GPO Dep.

The past year continued to be extremely productive following up two major breakthroughs made in the preceding year. One of the breakthroughs was the derivation of an integral equation for time-dependent power spectra, which unified all the existing theories on seismic scattering including the radiative transfer theory for total energy and single-multiple scattering theories based on the ray approach. We successfully applied the method to the data from the USGS regional seismic arrays in central California, Long Valley and Island of Hawaii, and obtained convincing results on the scattering Q^{-1} and intrinsic Q^{-1} in these areas for the frequency range from 1 Hz to 20 Hz. The frequency dependence of scattering Q^{-1} is, then, interpreted in terms of random medium with continuous or discrete scatterers. The other breakthrough was the application of T-matrix formulation to the seismic scattering problem. We are currently working on 2-dimensional inclusions with high and low velocity contrast with the surrounding medium. In addition to the above two main lines of research, we were able to use so-called "T-phase" observed on the Island of Hawaii to map the Q value with a good spatial resolution. We found that we can eliminate remarkably well the frequency dependent recording site effect from the T-phase amplitude using the amplification factor for coda waves, further confirming the fundamental separability of source, path and site effects for coda waves, and proving the effectiveness of stochastic modeling of high-frequency seismic waves. 70 refs., 24 figs.

7817 (DOE/ER/13840–2) **Workshop on quantitative dynamic stratigraphy: Final conference report.** Cross, T.A. Colorado School of Mines, Golden, CO (United States). Apr 1988. 18p. Sponsored by U.S. DOE Energy Research; National Science Foundation; Gas Research Institute; U.S. Geological Survey. DOE Contract FG02-88ER13840. (CONF-8802133–Summ.: Workshop on quantitative dynamic stratigraphy, Sedalia, CO (United States), 14-18 Feb 1988). Order Number DE92004246. Source: OSTI; NTIS; GPO Dep.

This document discusses the development of quantitative simulation models for the investigation of geologic systems. The selection of variables, model verification, evaluation, and future directions in quantitative dynamic stratigraphy (QDS) models are detailed. Interdisciplinary applications, integration, implementation, and transfer of QDS are also discussed. (FI)

7818 (DOE/ER/60574–T1) **Toward an understanding of global change: Initial priorities for US contributions to the International Geosphere-Biosphere Program.** National Research Council, Washington, DC (United States). Committee on Global Change. 1988. 213p. Sponsored by U.S. DOE Energy Research; U.S. Department of Defense; National Aeronautics and Space Administration; National Science Foundation; National Oceanic and Atmospheric Administration; U.S. Geological Survey. DOE Contract AI01-87ER60574. Contract OCE 8713699. Order Number DE92004303. Source: OSTI; NTIS; GPO Dep.

In the international scientific community, the International Council of Scientific Unions has organized the International Geosphere Biosphere Program (IGBP) to address the problems of global change. The objective of the IGBP is to describe and understand the interactive physical, chemical and biological processes that regulate the total earth system, the unique environment that it provides for life, the changes that are occurring in this system, and the manner in which they are influenced by human activities. The IGBP is currently in its preparatory phase, during which the program's goals and research components are slowly evolving and coming into focus. In this report, a limited number of high-priority research initiatives are recommended for early implementation as part of the US contribution to the preparatory phase of the IGBP. The recommendations are based on the committee's analysis of the most critical gaps, not being addressed by existing programs, in the scientific knowledge needed to understand the changes that are occurring in the earth system on time scales of decades to centuries. These initiatives will build upon the capabilities of the US program in global change.

7819 (LBL–30850) **Summary of the presentations at the international workshop on reducing carbon dioxide emissions from the developing world: Assessment of benefits, costs and barriers.** Sathaye, J.; Goldman, N. (eds.). Lawrence Berkeley Lab., CA (United States). Jun 1991. 50p. Sponsored by U.S. DOE Energy Research; Environmental Protection Agency. DOE Contract AC03-76SF00098. (CONF-9010449–Summ.: Workshop on reducing carbon emissions from the developing world: assessment of benefits, costs and barriers, Berkeley, CA (United States), 4-6 Oct 1990). Order Number DE92004171. Source: OSTI; NTIS; INIS; GPO Dep.

The "International Workshop on Reducing Carbon Dioxide Emissions from the Developing World: Assessment of Benefits, Costs and Barriers" was the second workshop held as part of a project being conducted by the International Energy Studies Group of Lawrence Berkeley Laboratory, in collaboration with experts from leading institutions across the developing world. The goal of the project is to analyze long-range energy consumption in developing countries and its potential contribution to global climate change. The US Environmental Protection Agency (EPA) is supporting this work, the results of which already have made a key contribution to the technical analysis being used as the basis for discussion by the Energy and Industry Sub-group of the Intergovernmental Panel on Climate Change (IPCC). The main purpose of this workshop was two-fold: (1) to discuss the feasibility of implementing the efficiency improvements and fuel switching measures incorporated into the long-term energy scenarios created for 17 developing countries and (2) to examine the costs and benefits of reducing energy-related carbon dioxide emissions generated by developing countries.

7820 (MPL-U–17/89) **[Studies of non-linear dynamics of dissipative systems]: [Final report, April 1, 1988–October 31, 1989].** Abarbanel, D.I. Scripps Institution of Oceanography, La Jolla, CA (United States). 10 Sep 1990. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract FG03-86ER13502. Order Number DE92004772. Source: OSTI; NTIS; GPO Dep.

In the period of this grant I worked on three main areas: (1) Symmetries in inviscid flow equations in one, two, and three dimensions and related nonlinear stability theorems for these flows; (2) applications of Hamiltonian mechanics to the problems of shallow water equations and internal wave dynamics in oceanic flows;

and, (3) analysis of signals from chaotic systems with an eye toward learning how to build models of chaotic systems in nature.

7821 (ORNL/ER/Sub–90-KA931/2) **Floodplain and wetlands assessment of the White Oak Creek Embayment.** Oak Ridge National Lab., TN (United States); CDM Federal Programs Corp., Oak Ridge, TN (United States). Jul 1991. 29p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC05-84OR21400. Order Number DE92003674. Source: OSTI; NTIS; GPO Dep.

This report describes the proposed methods for dealing with contaminants that have accumulated in White Oak Creek, White Oak Lake, and the White Oak Creek Embayment as a result of process releases and discharges from the Oak Ridge National Laboratory. Alternative methods of cleaning up the area which were considered in accordance with regulatory guidelines are listed, and information supporting the selected methods is provided. Also included are results of a site survey conducted at the White Oak Creek Embayment and the expected effects of the proposed control structures on the floodplain and wetlands. The appendix contains figures showing the nine cross-sections of the stream channel surveyed during studies of the White Oak Creek area.

7822 (UCID–20879) **Research and validation of seismic data from the Regional Seismic Test Network.** Nakanishi, K.K. Lawrence Livermore National Lab., CA (United States). 1988. 53p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE92004465. Source: OSTI; NTIS; GPO Dep.

Lawrence Livermore National Laboratory routinely conducts studies of the validity of seismic data obtained from the Department of Energy's Regional Seismic Test Network (RSTN). This paper is a report of work done from 1981 through 1985 using data from the RSTN. The results were first documented as internal memos, and this report is a compilation of all related memos during this period.

7823 (UCRL-JC–108853) **The computer hardware advanced mathematics and model physics (CHAMMP) climae modeling program.** Bader, D.C. (Pacific Northwest Lab., Richland, WA (United States)); MacCracken, M.C.; Malone, R.C. Lawrence Livermore National Lab., CA (United States). Nov 1991. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-9101125–1: 3. symposium for global change studies, Atlanta, GA (United States), 5-10 Jan 1991). Order Number DE92004671. Source: OSTI; NTIS; GPO Dep.

Improved methods for predicting the world's future climate and the potential climate change caused by anthropogenic activities are needed to guide domestic and international energy policy formulation. Current general circulation models (GCMs) of the atmosphere and ocean that form the basis for climate projections are useful, but lack treatment of interactions among the atmosphere, ocean, cryosphere and land surface; the inadequate representation of key processes such as radiative transfer and cloud development; and relatively coarse spatial resolution. The demands that must be met by future climate models have been established in the development of the US Global Change Research Program (USGCRP) and their importance is evidenced by the designation of Climate Modeling and Prediction as one of the four high priority integrating themes of the Program. The US DOE CHAMMP Program is a multiyear climate modeling research program designed to bring the computational power of emerging computer systems to further climate research. This requires true multidisciplinary collaboration among climate scientists, applied mathematicians and computer scientists. Since the ultimate goal is to provide better scientific prediction, research is also directed toward estimating the limits of climate predictability and the uncertainty of model results. Through interactions with other programs of the USGCRP and US High Performance Computing and Communications Program (HPCC), it will contribute to more definitive projections of climate change to aid in the formulation of national and international energy policy.

66 PHYSICS

6610 General Physics

Refer also to citation(s) 8421

7824 (UCRL–53868-90, pp. 1.1-1.5) **Computational electromagnetics and large parallel-processing computers.** Madsen, N.K. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

To improve the author's ability to analyze larger and larger problems of electromagnetic scattering, coupling, and propagation, he has begun to study the use of parallel-processing computers (PPCs) for numerically solving Maxwell's curl equations in the time domain. He has considered the use of both shared memory and distributed memory computer architectures and have concluded that the greatest performance gains in the near future will be with distributed memory machines. He has developed new and better algorithms for solving Maxwell's equations using unstructured grids and demonstrated their performance scalability on several distributed-memory PCCs. He has implemented a three-dimensional structured-grid version of a new algorithm on the distributed-memory, 128-processor Intel IPSC/i 860 PPC. He has also studied the possible use of a new, independent time-step method for use with the new algorithms and found this approach to be lacking in overall efficiency on shared-memory machines.

7825 (UCRL-JC–108128) **Helmholtz beam propagation by the method of Lanczos reduction.** Fleck, J.A. Jr. Lawrence Livermore National Lab., CA (United States). 6 Aug 1991. 12p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9109230–10: SPIE meeting, Boston, MA (United States), 3-6 Sep 1991). Order Number DE92003974. Source: OSTI; NTIS; GPO Dep.

The solution of the Helmholtz wave equation requires the application of an exponentiated square root operator to an initial field. This operation is greatly facilitated by the introduction of a representation in which the aforementioned operator is diagonal. The Lanczos method allows the diagonalization to be performed in a low dimensional space, e.g., of the order of 4-6, if one is interested in advancing the field over a limited propagation step of length Δz. Although some boundary conditions may be ill-posed for the unapproximated Helmholtz equation, in the sense that certain plane wave components cannot propagate in the forward direction, the Lanczos method damps all of these components exponentially, thus guaranteeing the correctness of the solution. 8 refs.

6611 Classical and Quantum Mechanics

Refer also to citation(s) 7260, 7871, 7878, 7903, 7972, 8004, 8145, 8204

7826 (DESY–91-082) **Staircase functions, spectral regidity and a rule for quantizing chaos.** Aurich, R. (Hamburg Univ. (Germany). 2. Inst. fuer Theoretische Physik); Steiner, F. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Jul 1991. 20p. Contract DFG Ste 241/4-3. Order Number DE92758902. Source: OSTI; NTIS (US Sales Only); INIS.

Considering the Selberg trace formula as an exact version of Gutzwiller's semiclassical periodic-orbit theory in the case of the free motion on compact Riemann surfaces with constant negative curvature (Hadamard-Gutzwiller model), we study two complementary basic problems in quantum chaology: the computation of the calssical staircase N(l), the number of periodic orbits with length shorter than l, in terms of the quantal energy spectrum $\{E_n\}$, the computation of the spectral staircase N (E), the number of quantal energies below the energy E, in terms of the length spectrum $\{l_n\}$ of the classical periodic orbits. A formulation of the periodic-orbit theory is presented which is intrinsically unsmoothed, but for which an effective smoothing arises from the limited 'input data', i.e. from the limited knowledge of the periodic orbits in the case of N(E) and the limited knowledge of quantal energies in the case of N(l). Based on the periodic-orbit formula for N(E), we propose a new rule for quantizing chaos, which simply states that the quantal energies are determined by the zeros of the function $\xi_1(E) = \cos(\pi N(E))$. The formulas for N(l) and N(E) as well as the new quantization condition are tested numerically. Furthermore, it is shown that the staircase N(E) computed from the length spectrum yields (up to a constant) a good description of the spectral rigidity $\Delta_3(L)$, being the first numerical attempt to compute a statistical property of the quantal energy spectrum of a chaotic system from classical periodic orbits. (orig.).

7827 (IC–91/248) **Hawking-like effects: Towards experiments.** Rosu, H. International Centre for Theoretical Physics, Trieste (Italy). Aug 1991. 23p. Order Number DE92614127. Source: OSTI; NTIS (US Sales Only); INIS.

We discuss the proposals made to detect Hawking radiation and Unruh radiation, and make brief comments on each of them. (author). 95 refs.

7828 (IC–91/258) **Inequivalence of interior and exterior dynamical problems.** Santilli, R.M. International Centre for Theoretical Physics, Trieste (Italy). Sep 1991. 14p. Order Number DE92615214. Source: OSTI; NTIS (US Sales Only); INIS.

We begin a series of notes with the review of the historical distinction by Lagrange, Hamilton, Jacobi and other Founding Fathers of analytic dynamics, between the exteriordynamical problem, consisting of motion in vacuum under action-at-a-distance interactions, and the interior dynamical problem, consisting of motion within a resistive medium with the additional presence of contact, nonlinear, nonlocal and nonhamiltonian internal forces. After recalling some of the historical reasons that led to the contemporary, virtually complete restriction of research to the exterior problem, we show that the interior dynamical problem cannot be reduced to the exterior one. This establishes the open character of the central objective of these notes: the identification of the space-time symmetries and relativities that are applicable to interior, nonlinear, nonlocal and nonhamiltonian systems. (author). 29 refs.

7829 (IC–91/265) **The notion of nonrelativistic isoparticle.** Santilli, R.M. International Centre for Theoretical Physics, Trieste (Italy). Sep 1991. 19p. Order Number DE92615215. Source: OSTI; NTIS (US Sales Only); INIS.

We introduce the notion of nonrelativistic isoparticle as a representation of a Galilei-isotopic symmetry studied in preceding works or, equivalently, as the generalization of the conventional notion of particle characterized by the isotopic liftings of the unit. We show that the lifting represents the transition from massive points moving in vacuum to extended-deformable particles moving within physical media. As explicit examples, we work out the cases of an extended-deformable particle: 1) in free conditions; 2) under external potential-selfadjoint interactions; and 3) under external potential-selfadjoint and nonhamiltonian-nonselfadjoint interactions. The emerging methods are applied to a first classical and nonrelativistic treatment of Rauch's experiments on the spinorial symmetry of thermal neutrons under external (magnetic and) nuclear fields. The notion nonrelativistic isoquark is submitted as a conceivable classical basis for future operator studies. (author). 12 refs, 1 fig.

7830 (IC–91/266) **Lie-admissible structure of Hamilton's original equations with external terms.** Santilli, R.M. International Centre for Theoretical Physics, Trieste (Italy). Sep 1991. 13p. Order Number DE92615216. Source: OSTI; NTIS (US Sales Only); INIS.

As a necessary additional step in preparation of our operator studies of closed nonhamiltonian systems, in this note we consider the algebraic structure of the original equations proposed by Lagrange and Hamilton, those with external terms representing precisely the contact nonpotential forces of the interior dynamical problem. We show that the brackets of the theory violate the conditions to characterize any algebra. Nevertheless, when properly written, they characterize a covering of the Lie-isotopic algebras called Lie-admissible algebras. It is indicated that a similar occurrence exists for conventional operator treatments, e.g. for nonconservative nuclear cases characterized by nonhermitean Hamiltonians. This occurrence then prevents a rigorous treatment of basic notions, such as that of angular momentum and spin spin, which are centrally dependent on the existence of a consistent algebraic structure. The emergence of the Lie-admissible algebras is therefore expected to be unavoidable for any rigorous operator treatment of open systems with nonlinear, nonlocal and nonhamiltonian external forces. (author). 14 refs, 1 fig.

7831 (IC–91/272) **Sheaves of Schwartz distributions.** Damyanov, B.P. International Centre for Theoretical Physics, Trieste (Italy). Sep 1991. 29p. Order Number DE92615217. Source: OSTI; NTIS (US Sales Only); INIS.

The theory of sheaves is a relevant mathematical language for describing the localization principle, known to be valid for the Schwartz distributions (generalized functions). After introducing some fundamentals of sheaves and the basic facts about distribution spaces, the distribution sheaf D_Ω of topological C-vector spaces over an open set Ω in R^n is systematically studied. A sheaf D_M of distributions on a C^∞-manifold M is then introduced, following a definition of Hoermander's for its particular elements. Further, a general definition of sheaves on a manifold, that are locally isomorphic to (or, modelled on) a sheaf on R^n, in proposed. The sheaf properties of D_M are studied and this sheaf is shown to be locally isomorphic to D_Ω, as a sheaf of topological vector spaces. (author). 14 refs.

7832 (IC–91/273) **The 4-vertex theorem for convex curves R^3.** Sedykh, V.D. International Centre for Theoretical Physics, Trieste (Italy). Sep 1991. 7p. Order Number DE92615218. Source: OSTI; NTIS (US Sales Only); INIS.

It is a well-known fact that any smooth closed plane curve with nowhere vanishing curvature has at least four vertices (local extremum points of its curvature). A generalization of this statement for the case of space curves is known as a conjecture of P. Scherk. Here we sketch the proof of this conjecture. (author). 5 refs.

7833 (IC–91/274) **Lax representation does not mean complete integrability.** Gerdjikov, V.S. International Centre for Theoretical Physics, Trieste (Italy). Sep 1991. 11p. Order Number DE92614128. Source: OSTI; NTIS (US Sales Only); INIS.

The gauge equivalence between the inhomogeneous versions of the nonlinear Schroedinger and the Heisenberg ferromagnet equations is studied. An unexplicit criterion for integrability is proposed. It is shown that in the nonintegrable cases the M-operators in the Lax representations possess pole singularities lying on the spectrum of the L-operators. (author). 14 refs.

7834 (IC–91/278) **Exactly soluble matrix models.** Raju Viswanathan, R. International Centre for Theoretical Physics, Trieste (Italy). Sep 1991. 9p. Order Number DE92615219. Source: OSTI; NTIS (US Sales Only); INIS.

We study examples of one dimensional matrix models whose potentials possess an energy spectrum that can be explicitly determined. This allows for an exact solution in the continuum limit. Specifically, step-like potentials and the Morse potential are considered. The step-like potentials show no scaling behaviour and the Morse potential (which corresponds to a $\gamma = -1$ model) has the interesting feature that there are no quantum corrections to the scaling behaviour in the continuum limit. (author). 5 refs.

7835 (LITH-MAT-R–89-38) **On the asymptotics of scattering phases for the Schroedinger equation.** Yafaev, D.R. (Leningrad Branch of Mathematical Institute (USSR)). Linkoeping Univ. (Sweden). Dept. of Mathematics. 22 Dec 1989. 18p. Order Number DE92614129. Source: OSTI; NTIS (US Sales Only); INIS.

Scattering phase are defined in terms of asymptotics of solutions of the Schroedinger equation behaving as standing waves at infinity. The scattering phases are connected in a simple way with the eigenvalues of the unitary operator $\Sigma = SI$ where S is the scattering matrix and I is the reflection operator. The eigenvalues of Σ can accumulate only at the points 1 and -1. It is shown that the leading terms of their asymptotics are determined only by the asymptotics of the even part of the potential at infinity. Explicit expressions for these terms are obtained. (au).

7836 (LIU-TEK-LIC–1991-26) **Quantum transport in semiconductor nanostructures and nanoscale devices.** Zhen-Li, Ji. Linkoeping Univ. (Sweden). Dept. of Physics and Measurement Technology. Sep 1991. 10p. Order Number DE92614130. Source: OSTI; NTIS (US Sales Only); INIS.

Only a decade ago the study and fabrication of electron devices whose smallest features were just under 1 micro represented the forefront of the field. Today that position has advanced an order of magnitude to 100 nanometers. Quantum effects are unavoidable in devices with dimensions smaller than 100 nanometers. A variety of quantum effects have been discovered over the years, such as tunneling, resonant tunneling, weak and strong localization, and the quantum Hall effect. Since 1985, experiments on nanostructures (dimension $<$ 100 nm) have revealed a number of new effects such as the Aharanov-Bohm effect, conductance fluctuations, nonlocal effects and the quantized resistance of point contacts. For nanostructures at low temperature, these phenomena clearly show that electron transport is influenced by wave interference effects similar to those well-known in microwave and optical networks. New device concepts now being proposed and demonstrated are based on these wave properties. This thesis discusses our study of electron transport in nanostructures. All of the quantum phenomena that we address here are essentially one-electron phenomena, although many-body effects will sometimes play a more significant role in the electronic properties of small structures. Most of the experimental observations to date are particularly well explained, at least qualitatively, in terms of the simple one-particle picture. (au).

7837 (YITP/U–91-24) **Non-perturbative effect of a modified action in matrix models.** Sawada, Shiro; Ueda, Haruhiko. Kyoto Univ., Uji (Japan). Yukawa Inst. for Theoretical Physics. May 1991. 10p. Order Number DE92750832. Source: OSTI; NTIS (US Sales Only); INIS.

A modified matrix model action, which may provide the well-defined two dimensional pure gravity theory, proposed by Das, Dhar, Sengupta and Wadia is analyzed non-perturbatively. The perturbative solution in genus expansion is also obtained. It is shown that the specific heat satisfies Painleve equation in the double scaling limit. Thus the modified action is found to be in the same universality class as ordinary matrix models. (author).

6612 Techniques of General Use in Physics

Refer also to citation(s) 7201, 7203, 7204, 7206, 7208, 7210, 7262, 7264, 7267, 7786, 7968, 8139, 8338

7838 (BNL–46868) **Solid neon moderated electrostatic or magnetic positron beam.** Weber, M. (Bielefeld Univ. (Germany). Fakultaet fuer Physik); Schwab, A.; Becker, D.; Lynn, K.G. Brookhaven National Lab., Upton, NY (United States). [1991]. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-9107196–1: Positron satellite meeting of ICPEAC, Sydney (Australia), 3-5 Jul 1991). Order Number DE92005033. Source: OSTI; NTIS; INIS; GPO Dep.

A high intensity variable energy positron beam has been constructed at Brookhaven National Laboratory (BNL). Positrons from a 97mCi ^{22}Na source are moderated by a thin layer of solid neon. A magnetic guiding system delivered up to $5\times10^6 e^+$/sec to an experiment. Currently tests are under way to facilitate the operation with the magnetic guiding system or – for other experimental sites – with an electrostatic beam transport. The electrostatic lenses are fabricated from μ-metal. No compensation of the earth magnetic field is required. Several experiments can utilize the beam on a time sharing basis. In the near future the source will be replaced by ^{64}Cu which has a much higher activity. Beam intensities up to $10^9 e^+$/sec are expected.

7839 (INP–1404/PL, pp. 251-253) **Transmitting-receiving head for spin echo observation on frequencies above 100 MHz.** Nadolski, S. (Polska Akademia Nauk, Warsaw (Poland). Inst. Fizyki). Institute of Nuclear Physics, Cracow (Poland). 1988. (In Polish). (CONF-8712174–: 20. national seminar on nuclear magnetic resonance and its applications, Cracow (Poland), 1-2 Dec 1987). In *Materials of 20. national seminar on nuclear magnetic resonance and its applications, Cracow, 1-2 December 1987.* 427p. Order Number DE92615136. Source: OSTI; NTIS (US Sales Only); INIS.

The transmitting-receiving head for spin echo observation in helium temperatures is described. Its scheme is given. (A.S.).

7840 (KEK–90-25(v.1), pp. 247-250) **Intense negative ion source.** Mori, Yoshiharu (National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

The volume H^- ion source has been developed at KEK. The H^- beam intensity was enhanced by introducing a very small amount of cesium vapor in the ion source. The extracted H^- beam current of 20 mA was obtained in the cesium-mode operation. The measured 90 % normalized beam emittance was about 1 πmm.mrad for 12 mA beam. It was found that the work function of the cesium covered surface of the beam extracting plasma electrode had an important role to enhance the H^- beam intensity. (author).

6613 Other Aspects of Physical Science

Refer also to citation(s) 6764, 7412, 7875, 7894, 7905, 7944

7841 (DESY–91-079) **A semiclassical approach to quantum gravity.** Salehi, H. (Hamburg Univ. (Germany). 2. Inst. fuer Theoretische Physik). Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Jul 1991. 14p. Order Number DE92758919. Source: OSTI; NTIS (US Sales Only).

The interaction of a scalar quantum field with gravity is investigated in the semiclassical context where the space-time is treated classically. It is essentially understood as a self-interaction of the quantum field, mediated by its own states. The relevant states here are not arbitrary but are selected by the principle of equivalence which is incorporated in form of specific nonlinear constraint equations. The quantum field is then subjected to a state dependent (nonlinear) field equation. Concluding, we comment on some problems concerning the consistency of the scheme employed. (orig.).

7842 (DOE/ER/40496–1) **Measurement of solar neutrinos in Kamiokande-2: Final report, January 1, 1989–December 31, 1989.** Beier, E. Pennsylvania Univ., Philadelphia, PA (United States). Nov 1991. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-89ER40496. Order Number DE92005344. Source: OSTI; NTIS; GPO Dep.

Work performed under this grant has resulted in the first direct observation of neutrinos produced by nuclear fusion reactions in the core of the sun. The quantitative results not only are the first direct confirmation that nuclear fusion is the source of solar power, but also place strong constraints on the properties of the neutrinos. During the course of the work, neutrinos from supernova SN1987a were observed. The observation of this signal confirms an important hypothesis of nuclear astrophysics, that gravitational collapse of the core of a massive star which has used up its nuclear fuel produces such as dense state of nuclear matter that neutrino emission is the principal mechanism for the escape of energy from the collapsed core.

7843 (IC–90/323) **On the spectrum of elementary type operator.** Khan, G.A. (International Centre for Theoretical Physics, Trieste (Italy)); Kyle, J. International Centre for Theoretical Physics, Trieste (Italy). Nov 1990. 5p. Order Number DE92614139. Source: OSTI; NTIS (US Sales Only); INIS.

Let H be a complex separable Hilbert space and let B(H) be the algebra of all bounded linear operators on H. Let $\{A_1,\ldots,A_n\}$ and $\{B_1,\ldots,B_n\}$ be two commuting families of self-adjoint operators in B(H). In this paper we are concerned with the investigation of the spectrum of the elementary type operator $\Gamma : B(H) \rightarrow B(H)$ defined by $\Gamma(X) = \Sigma^n{}_{i=1} A_i X B_i$ for all X in B(H). 8 refs.

7844 (IC–90/324) **Joint maximal numerical range.** Khan, G.A. (International Centre for Theoretical Physics, Trieste (Italy)); Kyle, J. International Centre for Theoretical Physics, Trieste (Italy). Nov 1990. 12p. Order Number DE92614140. Source: OSTI; NTIS (US Sales Only); INIS.

Let H be a complex Hilbert space and let B(H) be the algebra of all bounded linear operators on H. Let $T = (T_1,\ldots,T_n)$ denote an n-tuple of operators in B(H). The aim of this paper is to generalize the notion of maximal numerical range to n-tuple of operators and prove certain properties analogous to the single operator case. (author). 8 refs.

7845 (IC–90/356) **The inversion of the elements of the Clifford algebra.** Dang Khai. International Centre for Theoretical Physics, Trieste (Italy). Oct 1990. 4p. Order Number DE92614141. Source: OSTI; NTIS (US Sales Only); INIS.

The paper presents some results concerning the inversion of the elements of Clifford algebra, namely the construction of the right and left characteristic polynomials.

7846 (IC–90/458) **On some new integral differential inequalities of Gronwall-Bellman-Bihari type.** Imoru, C.O. International Centre for Theoretical Physics, Trieste (Italy). Dec 1990. 24p. Order Number DE92614142. Source: OSTI; NTIS (US Sales Only); INIS.

We establish in this paper some new Gronwall-Bellman-Bihari type integro-differential inequalities in n variables. These inequalities generalize, in some cases, the existing ones which are known to have a wide range of applications in the study of qualitative as well as quantitative properties of solutions of differential and integral equations. (author). 8 refs.

7847 (IC–91/60) **An estimate of the difference between consecutive eigenvalues.** Yang Hongcang. International Centre for Theoretical Physics, Trieste (Italy). Apr 1991. 8p. Order Number DE92615236. Source: OSTI; NTIS (US Sales Only); INIS.

Starting from the classical result obtained by Payne, Polya and Weinberger on the estimate of the difference between two consecutive eigenvalues, an attempt is made to improve these estimates. 5 refs.

7848 (IC–91/190) **Global solvability and hypoellipticity on the torus for a class of differential operators with variable coefficients.** Gramchev, T. (International Centre for Theoretical Physics, Trieste (Italy)); Popivanov, P.; Yoshino, M. International Centre for Theoretical Physics, Trieste (Italy). Jul 1991. 13p. Order Number DE92615228. Source: OSTI; NTIS (US Sales Only); INIS.

The present paper studies global hypoellipticity and global solvability on the two dimensional torus T^2 for a class of second order differential operators with variable coefficients of the type $P=(D_x-ia(x)D_y)\ (D_x-ib(x)D_y)+(a'(x)-b'(x))D_y+c(x)$. Necessary and/or sufficient conditions for global solvability and global hypoellipticity are proposed. In particular if $\mathrm{Re}a(x) \equiv 0$ and/or $\mathrm{Re}b(x) \equiv 0$ Siegel type conditions on the diophantine approximation of the averages $\int_0^{2\pi}\mathrm{Re}a(x)dx$ or/and $\int_0^{2\pi}\mathrm{Re}b(x)dx$ occur. We also indicate some results for more general class of operators and for the n-dimensional torus T^n, $n > 2$. (author). 18 refs.

7849 (IC–91/194) **Galaxies and stars: Basic building blocks of the universe.** Chu Yaoquan. International Centre for Theoretical Physics, Trieste (Italy). Jul 1991. 13p. Order Number DE92615229. Source: OSTI; NTIS (US Sales Only); INIS.

Recently there has been a rapid progress in our knowledge of the nature of the universe. Particularly, many new observational results show a strong challenge to the standard model of the universe. A selection of representative studies are reviewed, including the large scale distribution of dark matter and quasar-stellar objects (QSOs): the associations of low redshift galaxies with high redshift QSOs; the periodicity distribution of redshifts et. al. (author). 20 refs, 5 figs.

7850 (IC–91/225) **On the existence of n-dimensional indecomposable vector bundles.** Tan Xiaojiang. International Centre for Theoretical Physics, Trieste (Italy). Sep 1991. 22p. Order Number DE92615230. Source: OSTI; NTIS (US Sales Only); INIS.

Let X be an arbitrary smooth irreducible complex projective curve of genus g with $g \geq 4$. In this paper we extend the existence theorem of special divisors to high dimensional indecomposable vector bundles. We give a necessary and sufficient condition on the existence of n-dimensional indecomposable vector bundles E with $\deg(E) = d$, $\dim H^0(X,E) \geq h$. We also determine under what condition the set of all such vector bundles will be finite and how many elements it contains. (author). 9 refs.

7851 (IC–91/236) **Harmonic analysis and global solvability of a differential operator invariant on motion groups and semi-simple Lie groups.** El-Hussein, K. International Centre for Theoretical Physics, Trieste (Italy). Aug 1991. 40p. (In French). Order Number DE92615231. Source: OSTI; NTIS (US Sales Only); INIS.

Let V be a real finite dimensional vector space and let K be a connected compact Lie group, which acts on V by means of a continuous linear representation ρ. Let $G=V\ x_\rho\ K$ be the motion group which is the semi-direct product of V by K and let P be an invariant differential operator on G. In this paper we give a necessary and sufficient condition for the global solvability of P on G. Now let G be a connected semi-simple Lie group with finite centre and let P be an invariant differential operator on G. We give also a necessary and sufficient condition for the global solvability of P on G. (author). 8 refs.

7852 (IC–91/237) **Strong density of a class of simple operators.** Somasundaram, S.; Mohammad, N. International Centre for Theoretical Physics, Trieste (Italy). Aug 1991. 9p. Order Number DE92615232. Source: OSTI; NTIS (US Sales Only); INIS.

An algebra of simple operators has been shown to be strongly dense in the algebra of all bounded linear operators on function spaces of a compact (not necessarily abelian) group. Further, it is proved that the same result is also true for $L^2(G)$ if G is a locally compact (not necessarily compact) abelian group. (author). 6 refs.

7853 (IC–91/244) **A general relativistic hydrostatic model for a galaxy.** Hojman, R. (International Centre for Theoretical Physics, Trieste (Italy)); Pena, L.; Zamorano, N. International Centre for Theoretical Physics, Trieste (Italy). Aug 1991. 35p. Order Number DE92615233. Source: OSTI; NTIS (US Sales Only); INIS.

The existence of huge amounts of mass laying at the center of some galaxies has been inferred by data gathered at different wavelengths. It seems reasonable then, to incorporate general relativity in the study of these objects. A general relativistic hydrostatic model for a galaxy is studied. We assume that the galaxy is dominated by the dark mass except at the nucleus, where the luminous matter prevails. It considers four different concentric spherically symmetric regions, properly matched and with a specific equation of state for each of them. It yields a slowly raising orbital velocity for a test particle moving in the background gravitational field of the dark matter region. In this sense we think of this model as representing a spiral galaxy. The dependence of the mass on the radius in cluster and field spiral galaxies published recently, can be used to fix the size of the inner luminous core. A vanishing pressure at the edge of the galaxy and the assumption of hydrostatic equilibrium everywhere generates a jump in the density and the orbital velocity at the shell enclosing the galaxy. This is a prediction of this model. The ratio between the size core and the shells introduced here are proportional to their densities. In this sense the model is scale invariant. It can be used to reproduce a galaxy or the central region of a galaxy. We have also compared our results with those obtained with the Newtonian isothermal sphere. The luminosity is not included in our model as an extra variable in the determination of the orbital velocity. (author). 29 refs, 10 figs.

7854 (IC–91/245) **Characterizations of locally C*-algebras.** Mohammad, N.; Somasundaram, S. International Centre for Theoretical Physics, Trieste (Italy). Aug 1991. 10p. Order Number DE92615234. Source: OSTI; NTIS (US Sales Only); INIS.

We seek the generalization of the Gelfand-Naimark theorems for locally C^*-algebras. Precisely, if A is a unital commutative locally C^*-algebra, then it is shown that A is *-isomorphic (topologically and algebraically) to $C(\Delta)$. Further, if A is any locally C^*-algebra, then it is realized as a closed *-subalgebra of some L(H) up to a topological algebraic *-isomorphism. Also, a brief exposition of the Gelfand-Naimark-Segal construction is given and some of its consequences are discussed. (author). 16 refs.

7855 (IC–91/267) **A generalization of F. and M. Riesz Theorem.** Somasundaram, S. International Centre for Theoretical Physics, Trieste (Italy). Aug 1991. 9p. Order Number DE92614143. Source: OSTI; NTIS (US Sales Only); INIS.

A generalization of F. and M. Riesz Theorem for almost invariant operators on Homogeneous Banach spaces of compact abelian groups has been shown to be true for almost periodic operators in the case of non-compact abelian groups. (author) 7 refs.

7856 (IC–91/270) **Liouville theorem for exponentially harmonic function on Riemannian manifolds.** Hong Minchun. International Centre for Theoretical Physics, Trieste (Italy). Sep 1991. 8p. Order Number DE92615235. Source: OSTI; NTIS (US Sales Only); INIS.

Suppose that M is a complete Riemannian manifold with nonnegative sectional curvature. We prove that any bounded exponentially harmonic function on M is a constant function. (author). 7 refs.

7857 (IC–91/285) **On the unbounded behaviour for some non-autonomous systems in Banach spaces.** Djafari Rouhani, B. International Centre for Theoretical Physics, Trieste (Italy). Sep 1991. 13p. Order Number DE92614144. Source: OSTI; NTIS (US Sales Only); INIS.

By modifying our previous methods and by using the notion of integral solution introduced by Benilan, we study the asymptotic behaviour of unbounded trajectories for the quasi-autonomous dissipative system: du/dt + Au is not an element of f where X is a real Banach space, A an accretive (possibly multivalued) operator in X x X, and $f - f_\infty$ is an element of $L^p((0, +\infty);X)$ for some f_∞ is an element of X and $1 \leq p < \infty$. (author). 24 refs.

7858 (LAMP–91/7) **Propagation in non-linear media: Refractive index in non-linear media.** LAMP series report (Laser, Atomic and Molecular Physics). Faramawy, F.K. (Al-Azhar Univ., Cairo (Egypt). Faculty of Science); Abu Sitta, M.M.; Obada, A.S.F. International Centre for Theoretical Physics, Trieste (Italy). Aug 1991. 22p. Order Number DE92615237. Source: OSTI; NTIS (US Sales Only); INIS.

A general theory of the effect of the electronic coupling between molecules on the response of the system as a whole to an external electromagnetic field is presented. The role of the non-linear response function for various physical quantities and their Fourier transformation is discussed. The non-linear susceptibilities to any rank for a denaturated system of particles are calculated. Also the non-linear response function for a coupled system is computed. A non-linear susceptibility for the electric dipole is obtained. Methods of the linear theory are developed to obtain the total non-linear refractive index. (author). 17 refs.

7859 (LA-UR–91-3692) **Suppression of adjacent-channel and cochannel FM interference via extended Kalman filtering.** Bradley, J.N. Los Alamos National Lab., NM (United States). Nov 1991. 6p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract W-7405-ENG-36. (CONF-920354–2: 1992 IEEE international conference on acoustics, speech and signal processing, San Francisco, CA (United States), 23-26 Mar 1992). Order Number DE92003784. Source: OSTI; NTIS; GPO Dep.

A method is discussed for the problem of demodulating an FM signal in the presence of an adjacent-channel or cochannel interferer. State-space descriptions of the underlying message processes and the measurement process are presented which are then incorporated in an extended Kalman filter framework. The extended filter was necessary due to the nonlinearity of the measurement equation. The results of computer simulations are presented which demonstrate the system performance for various selections of the modulation index and signal separation. The derived system is contrasted to the previous state of the art in this area which involved maximum likelihood estimation. 5 refs.

7860 (LA-UR–91-4101) **Matrix models of 2d gravity.** Ginsparg, P. Los Alamos National Lab., NM (United States). [1991]. 24p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-9107195–1: Trieste summer school, Trieste (Italy), 22-25 Jul 1991). Order Number DE92004580. Source: OSTI; NTIS; INIS; GPO Dep.

These are introductory lectures for a general audience that give an overview of the subject of matrix models and their application to random surfaces, 2d gravity, and string theory. They are intentionally 1.5 years out of date.

7861 (LA-UR–91-4165) **Properties of multiple event gamma ray bursts.** Lochner, J.C. Los Alamos National Lab., NM (United States). [1991]. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-9110310–1: Gamma ray burst conference, Huntsville, AL (United States), 17-18 Oct 1991). Order Number DE92004574. Source: OSTI; NTIS; GPO Dep.

We present results from a study of 37 multiple event gamma ray bursts found in the monitoring data of the PVO gamma ray burst detector. We define these bursts as those which have two or more distinct emission events separated by a return to the background intensity. Significant correlation exists between the duration of the first event and the duration of the second event, while some correlation exists between the hardness of the events and only weak correlation exists in the intensity of the events. Although the time profiles of events in a burst may be similar, as measured in the phase portrait, there is no general rule about the degree of similarity of the time profiles. Subdividing the data according to the recurrence time, we find a tendency for the strength of the correlation in the hardness to increase with decreasing separation between the events. 2 refs., 2 figs., 1 tab.

7862 (SAND–91-2150) **Polarimetric calibration of a coherent measurement radar.** Brock, B.C. Sandia National Labs., Albuquerque, NM (United States). Dec 1991. 59p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE92004114. Source: OSTI; NTIS; GPO Dep.

The polarimetry problem (the measurement of the radar-cross-section polarization scattering matrix) is described. Two methods of calibrating a polarimetric radar are outlined. The first is a general multiple-calibration-target (MCT) method applicable to almost any radar system. The second is a simple, single-calibration-target (SCT) method applicable to systems which use a single antenna for both transmit/receive and a reciprocal RF network. The performance of the MCT method is examined through the use of Monte Carlo simulations. Finally, the SCT method is applied to measurements from the SCATTER facility, demonstrating about 40 dB isolation between polarization components in the frequency domain and in excess of 50 dB in the range domain.

7863 (UCRL-CR–108433) **Collaborative research on experimental astrophysics: Final report.** Lawrence Livermore National Lab., CA (United States). 17 Sep 1991. 2p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE92003970. Source: OSTI; NTIS; INIS; GPO Dep.

In association with the above subcontract, the Space Sciences Laboratory of the University of California at Berkeley (UCB) has pursued a program of experimental astrophysics research in collaboration with scientists at the Laboratory for Experimental Astrophysics of the Lawrence Livermore National Laboratory. This research program encompassed a number of disparate areas, which are: design and development of the GRATIS balloon payload; the multi-object spectrograph; investigation of the use of cryogenic detectors for non-dispersive X-ray spectroscopy; laboratory astrophysics investigations; and astronomical data analysis.

7864 (UCRL-ID–109126) **Effects of upwinding on the solution of a 1-D advection-diffusion problem.** Sahai, V. Lawrence Livermore National Lab., CA (United States). Dec 1991. 15p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE92004472. Source: OSTI; NTIS; GPO Dep.

A one-dimensional advection-diffusion problem whose solution is known was solved using TOPAZ2D. Two numerical upwinding techniques were used to damp out the numerical oscillations that occur. Comparisons between the exact and numerical solution were made.

7865 (UCRL-JC–109165) **The Fe L-shell spectrum in compact astrophysical x-ray sources.** Liedahl, D.A. (California Univ., Berkeley, CA (United States)); Kahn, S.M.; Goldstein, W.H.; Osterheld, A.L. Lawrence Berkeley Lab., CA (United States). 2 Dec 1991. 9p. Sponsored by U.S. DOE Defense Programs; National Aeronautics and Space Administration. DOE Contract W-7405-ENG-48. (CONF-910810–6: 7. international symposium on high voltage engineering (ISH-7), Dresden (Germany), 26-30 Aug 1991). Order Number DE92005245. Source: OSTI; NTIS; GPO Dep.

Compact X-ray sources derive their luminosities from the conversion of gravitational potential energy through accretion. A centrally-produced hard X-ray continuum photoionizes the surrounding accretion flow, which can produce discrete X-ray emission. To date, as applied to compact X-ray sources, a detailed diagnostic approach to the analysis of spectroscopic data has been largely ineffective, owing to the limited quality of available line spectra and the lack of appropriate models of X-ray line emission in the presence of an ionizing continuum radiation field. We are involved in an atomic modeling program to investigate the discrete spectral response to variations in ambient plasma conditions, with the aim of establishing a new set of plasma diagnostics appropriate to this physical regime. We discuss the physical mechanisms and applications of several of the diagnostics which have been discovered in the Fe L-shell spectrum, under conditions appropriate to X-ray photoionized plasmas.

6620 Physics of Elementary Particles and Fields

Refer also to citation(s) 7261, 7263, 7265, 7266

7866 (DOE/ER/02289–15) **Northwestern University technical progress reports, December 1, 1990–November 30, 1991.** Rosen, J.; Block, M.; Buchholz, D.; Gobbi, B.; Schellman, H.; Miller, D.; Braaten, E.; Chang, D.; Oakes, R. Northwestern Univ., Evanston, IL (United States). [1991]. 64p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76ER02289. Order Number DE92004203. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses research in High Energy Physics at Northwestern University. Topic discusses are charmonium production, photoproduction, deep inelastic muon scattering, particle decays, cp violation, standard model, neutrino mass, Do detectors, and other High Energy research. (LSP)

7867 (DOE/ER/40633–1) **High energy physics program at Texas A and M University: Annual report, April 1, 1991–March 31, 1992.** Texas A and M Univ., College Station, TX (United States). Dept. of Physics. Oct 1991. 185p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-91ER40633. Order Number DE92004426. Source: OSTI; NTIS; INIS; GPO Dep.

The Texas A&M experimental high energy physics program continued to reach significant milestones in each of its research initiatives during the course of the past year. We are participating in two major operating experiments, CDF and MACRO. In CDF, the Texas A&M group has spearheaded the test beam program to recalibrate the Forward Hadron Calorimeter for the upcoming CDF data run, as well as contributing to the ongoing analysis work on jets and b-quarks. In MACRO, we have assisted in the development of the final version of the wave form digitizing system being implemented for the entire scintillator system. The construction of the first six supermodules of the detector has been completed and all six are currently taking data with streamer chambers while four have the completed scintillator counter system up and running. We have built and tested prototypes of a liquid-scintillator fiber calorimeter system, in which internally reflecting channels are imbedded in a lead matrix and filled with liquid scintillator. This approach combines the performance features of fiber calorimetry and the radiation hardness of liquid scintillator, and is being developed for forward calorimetry at the SSC. The microstrip chamber is a new technology for precision track chambers that offers the performance required for future hadron colliders. The theoretical high energy physics program has continued to develop during the past funding cycle. We have continued the study of their very successful string-derived model that unifies all known interactions; flipped SU(5), which is the leading candidate for a TOE. Work has continued on some generalizations of the symmetries of string theory, known as W algebras. These are expected to have applications in two-dimensional conformal field theory, two-dimensional extensions of gravity and topological gravity and W-string theory.

7868 (GSI–90-02) **The 1990 GSI research and development programme (including programme budgeting).** Ahrens, H. (comp.). Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany). 1990. 69p. (In German). Order Number DE92750132. Source: OSTI; NTIS (US Sales Only); INIS.

The annual report surveys the research programs and activities in the field of nuclear and atomic heavy ion research, performed with the UNILAC, SIS and ESR devices, with positron spectroscopy and research on quasimolecular X-ray spectra currently being the points of main interest. Theoretical research work studied relativistic transport theories and particle production in high Coulomb fields. Research work with heavy ions in other scientific research fields was devoted to plasma physics, materials research, and biophysics, and to new technologies and manufacturing methods for targets and detectors. (DG).

7869 (SSCL-SR–1181) **HEPLIB '91: International users meeting on the support and environments of high energy physics computing.** Johnstad, H. Superconducting Super Collider Lab., Dallas, TX (United States). [1991]. 498p. Sponsored by U.S. DOE Energy Research. DOE Contract AC35-89ER40486. (CONF-9109320–: HEPLIB '91 international users meeting on the support and environments of high energy physics computing, Dallas, TX (United States), 19-20 Sep 1991). Order Number DE92004300. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this meeting is to discuss the current and future HEP computing support and environments from the perspective of new horizons in accelerator, physics, and computing technologies. Topics of interest to the Meeting include (but are limited to): the forming of the HEPLIB world user group for High Energy Physic computing; mandate, desirables, coordination, organization, funding; user experience, international collaboration; the roles of national labs, universities, and industry; range of software, Monte Carlo, mathematics, physics, interactive analysis, text processors, editors, graphics, data base systems, code management tools; program libraries, frequency of updates, distribution; distributed and interactive computing, data base systems, user interface, UNIX operating systems, networking, compilers, Xlib, X-Graphics; documentation, updates, availability, distribution; code management in large collaborations, keeping track of program versions; and quality assurance, testing, conventions, standards.

6621 General Theory of Particles and Fields

Refer also to citation(s) 7265, 7860, 7912, 7915, 7917, 7934, 7970, 7973, 8055

7870 (BONN-HE–91-16) **Characters and representations of new fermionic W-algebras.** Varnhagen, R. Bonn Univ. (Germany). Physikalisches Inst. Aug 1991. 9p. Order Number DE92758920. Source: OSTI; NTIS (US Sales Only); INIS.

W-algebras are extensions of the Virasoro algebra describing chiral subalgebras of conformal quantum field theories. Careful analysis of the four-point functions and consideration of the invariant spaces under a subgroup of the modular group $SL(2,_{Z})$ allow one to find all representations of new classes of fermionic W-algebras constructed recently. For each of these W-algebras there exists only a finite number of representations. The corresponding fusion rules are calculated. (orig.).

7871 (BONN-IR–91-44) **The thermal perturbation of the Z_5 quantum chain with Fateev-Zamolodchikov symmetry.** Kaldenbach, L. Bonn Univ. (Germany). Physikalisches Inst.; Bonn Univ. (Germany). Mathematisch-Naturwissenschaftliche Fakultaet. Jul 1991. 76p. (In German). Order Number DE92758915. Source: OSTI; NTIS (US Sales Only); INIS.

We calculate numerically the lowest levels in the spectrum of the Z_5 Fateev-Zamolodchikov quantum chain perturbed by a thermal operator. We find that the ground state energy of the quantum chain is consistent with the result of the thermodynamic Bethe-Ansatz calculations. The finite-size corrections to the one-particle energies are compared with results obtained by Klassen and Melzer. At least for states with two equal particles the scattering phase shift calculated by Luescher's method reproduces the minimal solution for the S-matrix given by Koeberle and Swieca. For two-particle states with different particles this method does not work. In a second part of the work we investigate the level statistics of a Z_3-invariant quantum chain. For some of the integrable points recently proposed by de Vega and Lopes we find Poisson statistics. The other ones display level repulsion. (orig.).

7872 (DESY–91-088) **The average action for scalar fields near phase transitions.** Wetterich, C. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Aug 1991. 82p. Order Number DE92758963. Source: OSTI; NTIS (US Sales Only); INIS.

We compute the average action for fields in two, three and four dimensions, including the effects of wave function renormalization. A study of the one loop evolution equations for the scale dependence of the average action gives a unified picture of the qualitatively different behaviour in various dimensions for discrete as well as abelian and nonabelian continuous symmetry. The different phases and the phase transitions can be infered from the evolution equation. (orig.).

7873 (DESY–91-113) **On the general theory of quantized fields.** Fredenhagen, K. (Hamburg Univ. (Germany). 2. Inst. fuer Theoretische Physik). Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Oct 1991. 20p. (CONF-9107201–: 10. IAMP congress on mathematical physics, Leipzig (Germany), 30 Jul - 9 aug 1991). Order Number DE92759312. Source: OSTI; NTIS (US Sales Only); INIS.

In my lecture I describe the present stage of the general theory of quantized fields on the example of 5 subjects. They are ordered in the direction from large to small distances. The first one is the by now classical problem of the structure of superselection sectors. It involves the behavior of the theory at spacelike infinity and is directly connected with particle statistics and internal symmetries. It has become popular in recent years by the discovery of a lot of nontrivial models in 2d conformal-field theory, by connections to integrable models and critical behavior in statistical mechanics and by the relations to the Jones' theory of subfactors in von Neumann algebras and to the corresponding geometrical objects (braids, knots, 3d manifolds, ...). At large timelike distances the by far most important feature of quantum field theory is the particle structure. This will be the second subject of my lecture. It follows the technically most involved part which is concerned with the behavior at finite distances. Two aspets, nuclearity which emphasizes the finite density of states in phase space, and the modular structure which relies on the infinite number of degrees of freedom present even locally, and their mutual relations will be treated. The next point, involving the structure at infinitesimal distances, is the connection between the Haag-Kastler framework of algebras of local and the framework of Wightman fields. Finally, problems in approaches to quantum gravity will be discussed, as far as they are accessible by the methods of the general theory of quantized fields. (orig.).

7874 (DOE/ER/40107–10B) **Research in particle physics beyond the standard model (Task B): Progress report, 1990–1991.** Samuel, S. City Coll., New York, NY (United States). Dept. of Physics. [1991]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-83ER40107. Order Number DE92004049. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses string physics and bosonic technicolor. (LSP).

7875 (DOE/ER/40153–8) **Research in particle theory: Annual progress report, December 1, 1990–October 10, 1991.** Mansouri, F.; Suranyi, P; Wijewardhana, L.C.R. Cincinnati Univ., OH (United States). Oct 1991. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-84ER40153. Order Number DE92004070. Source: OSTI; NTIS; INIS; GPO Dep.

In the test particle approximation, the scattering amplitude for two-particle scattering in (2+1)-dimensional Chern-Simons-Witten gravity and supergravity was computed and compared to the corresponding metric solutions. The formalism was then extended to the exact gauge theoretic treatment of the two-particle scattering problem and compared to 't Hooft's results from the metric approach. We have studied dynamical symmetry breaking in 2+1 dimensional field theories. We have analyzed strong Extended Technicolor (ETC) models where the ETC coupling is close to a critical value. There are effective scalar fields in each of the theories. We have worked our how such scalar particles can be produced and how they decay. The ϕ^4 field theory was investigated in the Schrodinger representation. The critical behavior was extracted in an arbitrary number of dimensions in second order of a systematic truncation approximation. The correlation exponent agrees with known values within a few percent.

7876 (IC–91/114) **Mended chiral symmetry and the linear sigma model in one-loop order.** Scadron, M.D. International Centre for Theoretical Physics, Trieste (Italy). Jun 1991. 11p. Order Number DE92609741. Source: OSTI; NTIS (US Sales Only); INIS.

It is shown that the linear σ model in one-loop order in the chiral limit recovers meson masses $m_\pi = 0$, $m_\sigma = 2m_{qk}$ (NJL), $m_\rho = \sqrt{2}\, g_\rho f_\pi$ (KSRF), along with couplings $g_{\sigma\pi\pi} = m^2{}_\sigma/2f_\pi, g_{\rho\pi\pi} = g_\rho$ (VMD universality) and Weinberg's mended chiral symmetry decay width relation $\Gamma_\sigma = (9/2)\Gamma_\rho$. (author). 15 refs, 5 figs.

7877 (IC–91/124) **Higher genus string corrections to gauge couplings.** Antoniadis, I. (Ecole Polytechnique, 91 - Palaiseau (France). Centre de Physique Theorique); Taylor, T.R.; Narain, K.S. International Centre for Theoretical Physics, Trieste (Italy). Jun 1991. 20p. (NUB–3025;CPTH–A050.0491.). Order Number DE92609090. Source: OSTI; NTIS (US Sales Only); INIS.

Dependence of the gauge couplings on the moduli of the compactified space is studied for orbifold compactifications of the heterotic superstring. It is shown that such dependence is possible only for theories with sectors preserving N = 2 spacetime supersymmetry, and it satisfies a non-renormalization theorem. Namely, it is given entirely at the one-loop level and is determined by the violation of the integrability of 0-angle with respect to the moduli. (author). 23 refs.

7878 (IC–91/147) **Reduction of the dirac equation and relation with the Ivanenko-Landau-Kaehler equation.** Obukhov, Yu.N. (Moscow State Univ., Moscow (USSR). Dept. of Theoretical Physics); Solodukhin, S.N. International Centre for Theoretical Physics, Trieste (Italy). Jul 1991. 29p. Order Number DE92609094. Source: OSTI; NTIS (US Sales Only); INIS.

We consider the spinor theory within the framework of the inhomogeneous differential forms formalism. We also consider the possibility of describing fermions with the help of the Ivanenko-Landau-Kaehler equation. The relations between these two equations are studied. (author). 29 refs.

7879 (IC–91/157) **Analytic formulae for the neutralino masses and the neutralino mixing matrix.** El Kheishen, M.M. (Cairo Univ. (Egypt). Dept. of Physics); Aboshousha, A.A.; Shafik, A.A. International Centre for Theoretical Physics, Trieste (Italy). Jun 1991. 15p. Order Number DE92609771. Source: OSTI; NTIS (US Sales Only); INIS.

The exact formulae for the neutralino mixing matrix and their masses are derived. These formulae have been proven to be correct through comparison with the numerical solution of the system of equations containing the masses and the matrix elements, as well as approximated formulae previously published. (author). 10 refs, 6 figs.

7880 (IC–91/204) **Self-dual spin-3 and 4 theories.** Aragone, C. (Simon Bolivar Univ., Caracas (Venezuela). Dept. de Fisica); Khoudeir, A. International Centre for Theoretical Physics, Trieste (Italy). Aug 1991. 15p. Order Number DE92614147. Source: OSTI; NTIS (US Sales Only); INIS.

We present self-dual pure spin-3 and 4 actions using the physical relevant Dreibein fields. Since these actions start with a Chern-Simons like kinetic term (and therefore cannot be obtained through dimensional reduction) one might wonder whether they need the presence of auxiliary, ghost-killing fields. It turns out that they must contain, also in this three dimensional case, auxiliary fields. Auxiliary scalars do not break self-duality; their free action does not contain kinetic terms. (author). 12 refs.

7881 (IC–91/238) **Classical gravity coupled to Liouville theory.** Mazzitelli, F.D.; Mohammedi, N. International Centre for Theoretical Physics, Trieste (Italy). Aug 1991. 22p. Order Number DE92615238. Source: OSTI; NTIS (US Sales Only); INIS.

We consider the two dimensional Jackiw-Teitelboim model of gravity. We first couple the model to the Liouville action and c scalar fields and show, treating the combined system as a non linear sigma model, that the resulting theory can be interpreted as a critical string moving in a target space of dimension D=c+2. We then analyze the model from a perturbative point of view. We show in particular that the results of conformal field theory are exactly reproduced at the one-loop level. We also show that the theory is one loop finite if the cosmological constant Λ is equal to zero. When Λ is different from zero the one loop divergences are gauge-fixing dependent even on-shell. However, the theory can be renormalized as a non linear sigma model if a kinetic term is included for the auxiliary field. (author). 27 refs.

7882 (IC–91/243) **Some particular solutions of the N-body problem on the line, obtained from supersymmetry.** Gonzalez, A. (International Centre for Theoretical Physics, Trieste (Italy)); Gonzalez, R. International Centre for Theoretical Physics, Trieste (Italy). Aug 1991. 7p. Order Number DE92615258. Source: OSTI; NTIS (US Sales Only); INIS.

Supersymmetry is used in order to construct a class of N-body bosonic Hamiltonians in one spatial dimension, for which the ground state energy and wave function can be explicitly written. The corresponding interaction among particles is described by N-body, nonsingular potentials. (author). 7 refs.

7883 (IC–91/261) **Rotational-isotopic symmetries.** Santilli, R.M. International Centre for Theoretical Physics, Trieste (Italy). Sep 1991. 16p. Order Number DE92615259. Source: OSTI; NTIS (US Sales Only); INIS.

In this note we submit a nonlocal (integral) generalization of the rotational-isotopic symmetries O-circumflex(3) introduced in preceding works for nonlinear and nonhamiltonian systems in local approximation. By recalling that the Lie-isotopic theory naturally admits nonlocal terms when all embedded in the isounit, while the conventional symplectic geometry is strictly local-differential, we introduce the notion of symplectic-isotopic two-forms, which are exact symplectic two-forms admitting a factorization into the Kronecker product of a canonical two-form time the isotopic element of an underlying Euclidean-isotopic space. Topological consistency is then achieved by embedding all nonlocal terms in the isounit of the iso-cotangent bundle, while keeping the local topology for the canonical part. In this way, we identify the symplectic-isotopic geometry as being the natural geometrical counterpart of the Lie-isotopic theory. The results are used for the introduction of the notion of Birkhoffian angular momentum, that is, the generalization of the conventional canonical angular momentum which is applicable to Birkhoffian systems with generally nonlinear, nonlocal and nonhamiltonian internal forces. The generators J (and the parameters θ) coincide with the conventional quantities. Nevertheless, the quantity J is defined on the underlying Euclidean-isotopic space, by therefore acquiring a generalized magnitude. The isocommutation rules and isoexponentiation of the Birkhoffian angular momentum are explicitly computed and shown to characterize the most general known nonlinear and nonlocal realization of the isorotational symmetry. The local isomorphisms between the infinitely possible isotopes O-circumflex(3) and the conventional symmetry O(3) is proved. Finally the isosymmetries O-circumflex(3) are used to characterize the conserved, total, Birkhoffian angular momentum of closed nonselfadjoint systems. (author). 4 refs.

7884 (IC–91/262) **Euclidean-isotopic symmetries.** Santilli, R.M. International Centre for Theoretical Physics, Trieste (Italy). Sep 1991. 8p. Order Number DE92615260. Source: OSTI; NTIS (US Sales Only); INIS.

In this note we introduce the largest possible nonlinear and nonlocal symmetries of the separation $(r_{ia}-r_{ib})G_{ij}(r,r',r''\ldots)(r_{ja}-r_{jb})$, ij=1,2,3, a,b=1,2,...,N, in a Euclidean-isotopic space E-circumflex(r,G,A-circumflex) with isometric G; we identify their Lie-isotopic structure E-circumflex(3), here called Euclidean-isotopic symmetries; and we show that they are all locally isomorphic to the conventional Euclidean symmetry E(3) under the condition of positive-definiteness of the isometric. (author). 1 ref.

7885 (IC–91/263) **Galilei-isotopic symmetries.** Santilli, R.M. International Centre for Theoretical Physics, Trieste (Italy). Sep 1991. 14p. Order Number DE92615261. Source: OSTI; NTIS (US Sales Only); INIS.

We construct the most general known classical, nonlinear and nonlocal generalization of the conventional Galilei transformations, as well as the corresponding classical realization of the infinite family of Galilei-isotopic symmetries G-circumflex (3.1) proposed in preceding works, under the condition that they result to be all locally isomorphic to the conventional Galilei symmetry. The symmetries G-circumflex (3.1) are then used to characterize the largest possible class of nonlinear, nonlocal and nonhamiltonian Newtonian systems which still verify the conservation laws of all ten, total, physical quantities, as preparatory grounds for subsequent operator studies for the hadronic structure. The method for the explicit construction of the space-time isosymmetries G-circumflex (3.1) from given Galilei-noninvariant equations of motion is outlined. (author). 11 refs.

7886 (JINR-E–2-90-309) **Relativistic nucleon.** Belyakov, V.A.; Strel'tsov, V.N. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy. 1990. 7p. Order Number DE92609098. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Z. Phys., C.

It is noted that the pion and vector meson fields of the relativistic nucleon behave in different ways. The contribution of the vector meson field increases with increasing energy and becomes dominating at γ>or approx. 10^2(γ is the Lorentz factor). This leads to the growth of the transverse size for the nucleon. As a result, the character of peripheral and central collision changes (the former is determined by vector exchange). The cross section of ρ and ω production increases. A significant contribution to the spin effect is expected. The opinion is expressed that the indicated growth of the transverse size of the nucleon leads to increasing the total cross section of nucleon interaction at high energy. 9 refs.; 3 figs.; 1 tab.

7887 (JINR-E–2-90-354) **Relativistic bound states in QCD.** Kalinovskij, Yu.L. (Gomel'skij Politekhnicheskij Inst., Gomel (Byelorussian SSR)); Kallies, W.; Kaschluhn, L.; Muenchow, L.; Pervushin, V.N.; Sarikov, N.A. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics. 1990. 19p. Order Number DE92609099. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Few-Body Systems.

This paper is devoted to the construction of the nonlocal theory of hadrons as bound states of quarks and gluons. The starting point of our investigation is relativistic covariant definition of instantaneous bound states and the supposition of the dominance of an instantaneous gluon interaction. The description of the nonlocal relativistic pion to the case of many-quark and many-gluon configurations using an operator approach is generalized. 31 refs.

7888 (JINR-E–2-90-364) **Generalized field quantization and the Pauli principle.** Govorkov, A.B. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics. 1990. 25p. Order Number DE92609100. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to the Fifth Intern. Conf. on Hadronic Mechanics and Nonpotential Interactions, 13-17 Aug, 1990, USA.

The work is an attempt to prove that the generalized Pauli principle (i.e. Fermi statistics) for the half-integer spin fields and the Bose statistics for the integer spin fields with allowance for the existence of internal gauge symmetries are consequences of more general assumptions of the local quantum field theory. 32 refs.; 1 tab.

7889 (JINR-E–2-90-383) **On generation mechanisms of spin effects in QCD at large distances.** Goloskokov, S.V. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics. 1990. 9p. Order Number DE92609101. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to the Intern. Seminar 'QUARKS-90', May 14-19 1990, Tbilisi, USSR.

The discussion of the different physical mechanisms with lead to the spin-flip amplitude growing as s at high energies and fixed momenta transfer is done. 14 refs.; 3 figs.

7890 (JINR-E–2-90-402) **Path integral for the Yang-Mills theory in a nonperturbative region.** Shabanov, S.V. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics. 1990. 16p. Order Number DE92609102. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Phys. Lett., B.

The choice of physical variables in gauge theories is discussed. It is shown that the quantum description is independent of the choice of physical degrees of freedom if physical variables are considered curvilinear in the path integral approach. Then, the conventional path integral with a gauge condition is modified. The found path integral is used for the quantum descritpion of the Yang-Mills fields with an ambiguous gauge (Gribov's problem). 19 refs.

7891 (JINR-R–2-90-104) **Superstring Z' boson at the $c\tau$ factory.** Bednyakov, V.A. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems. 1990. 10p. (In Russian). Order Number DE92609714. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Yad. Fiz.

The measurements of the electroweak asymmetries with accuracy 1-5 per cent have opened the opportunity to get new restrictions on superstring Z'-boson parameters, to obtain $\sin^2\Theta_W$ in the low-energy region with good precision and to determine the weak neutral τ-lepton current in e^+e^--collisions at $\sqrt{s}$=3-5 GeV ($c\tau$-factory). 11 refs.; 2 figs.; 1 tab.

7892 (JINR-R–4-90-404) **Divergent potentials in multipole quantum electrodynamics.** Shirokov, M.I. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics. 1990. 14p. (In Russian). Order Number DE92609103. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to J. Phys., A.

The multiple form of quantum electrodynamics containing the interaction eq-vectorxE-vector is discussed. Its hamiltonian has a divergent operator term. The available treatment of the trouble seems unsatisfactory. A potential-like nature of the term is ascertained using a regularization. A generalization of the multipole form is suggested in which the term divergency is reduced. It is shown that the obtained interaction with photons is still equal to eq-vectorxE-vector in the dipole approximation, and interatomic Coulomb interactions are absent. 11 refs.

7893 (KEK-PROC–91-6) **Proceedings of the workshop 'superstrings and conformal field theories'.** Kobayashi, Makoto; Kato, Mitsuhiro (eds.). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jul 1991. 284p. (CONF-9012128–: Workshop 'superstrings and conformal field theories', Tsukuba (Japan), 18-21 Dec 1990). Order Number DE92751044. Source: OSTI; NTIS (US Sales Only); INIS.

This issue is the collection of the papers presented at the title meeting. The 24 of the presented papers are indexed individually. (J.P.N.).

7894 (LBL–31325) **Superspace WZW models and black holes.** Rocek, M. (Institute for Advanced Study, Princeton, NJ (United States). School of Natural Sciences); Ahn, C.; Schoutens, K.; Sevrin, A. Lawrence Berkeley Lab., CA (United States). Oct 1991. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (IASSNS-HEP–91/69;ITP-SB–91-49;UCB-PTH–91/50;CONF-9108185–1: Workshop on superstrings and related topics, Trieste (Italy), Aug 1991). Order Number DE92004169. Source: OSTI; NTIS; INIS; GPO Dep.

We show how to write an off-shell action for the SU(2) x U(1) supersymmetric WZW model in terms of N = 2 chiral and twisted chiral multiplets. We discuss the N = 4 supersymmetry of this model and exhibit the N = 4 superconformal current algebra. Finally, we show that the off-shell formulation makes it possible to perform a duality transformation, which leads to a supersymmetric sigma model on a manifold with a black hole type singularity. 23 refs.

7895 (NIKHEF-H–91-18) **The FORM version of MINCER.** Larin, S.A. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H); Tkachov, F.V. Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H. 1991. 39p. Order Number DE92614148. Source: OSTI; NTIS (US Sales Only); INIS.

This work is supported in part by the Natural Sciences and Research Council of Canada and the Quebec Committee of Education, Canada.

The program MINCER for massless three-loop Feynman diagrams of the propagator type has been reprogrammed in the language of FORM. The new version is thoroughly optimized and can be run from a utility like the UNIX make, which allows one to conveniently process large numbers of diagrams. It has been used for some calculations that were previously not practical. (author). 22 refs.; 14 figs.

7896 (YITP/U–90-29) **On matrix realization of random surfaces.** Sasaki, Misao; Suzuki, Hiroshi. Kyoto Univ., Uji (Japan). Yukawa Inst. for Theoretical Physics. Dec 1990. 35p. Order Number DE92750826. Source: OSTI; NTIS (US Sales Only); INIS.

The large N one-matrix model with a potential, $V(\phi) = \phi^2/2 + g_4\phi^4/N + g_6\phi^6/N^2$ is carefully investigated using the orthogonal polynomial method. We present a numerical method to solve the recurrence relation and evaluate the recursion coefficients r_k ($k = 1,2,3,\ldots$) of the orthogonal polynomials at large N. We find that for $g_6/g_4^2 > 1/2$ there is no m = 2 solution which can be expressed as a smooth function of k/N in the limit $N \to \infty$. This means that the assumption of smoothness of r_k at $N \to \infty$ near the critical point, which was essential to derive the string susceptibility and the string equation, is broken even at the tree level of the genus expansion by adding the ϕ^6-term. We have also observed the free energy around the (expected) critical point to confirm that the system does not have the desired criticality as pure gravity. Our (discouraging) results for m = 2 are complementary to previous analyses by the saddle point method. On the other hand, for the case m = 3 ($g_6/g_4^2 = 4/5$), we find a well-behaved solution which coincides with the result by Brezin et al.. To strengthen the validity of our numerical scheme, we present in appendix a non-perturbative solution for m = 1 which obeys the so-called type-II string equation proposed by Demeterfi et al.. (author).

7897 (YITP/U–90-30) **Gauge symmetry in extended objects and the stability of compactified membranes.** Fujikawa, Kazuo; Kubo, Jisuke. Kyoto Univ., Uji (Japan). Yukawa Inst. for Theoretical Physics. Nov 1990. 27p. Order Number DE92750827. Source: OSTI; NTIS (US Sales Only); INIS.

A large number of gauge degrees of freedom inherent in relativistic extended objects often cause dynamical instability. This problem is studied by taking bosonic membranes and balls as examples. The bosonic membrane with two spatial coordinates compactified is examined in detail, and it is pointed out that the compactification produces a stabilizing potential barrier for the variables orthogonal to the compactified spaces. By gauge transforming away the variables in the compactified spaces, we suggest a possible confinement of unstable modes in compactified spaces. (author).

7898 (YITP/U–91-4) **Affine Toda Field Theory: S-matrix vs perturbation.** Braden, H.W. (Edinburgh Univ. (United Kingdom). Dept. of Mathematics); Corrigan, E.; Dorey, P.E.; Sasaki, R. Kyoto Univ., Uji (Japan). Yukawa Inst. for Theoretical Physics. Jan 1991. 16p. Order Number DE92750828. Source: OSTI; NTIS (US Sales Only); INIS.

We have given several pieces of evidence that perturbation theory manages to reproduce various salient features of the conjectured exact S-matrices of ATFT. At present, we do not see how to use perturbation theory to provide an efficient description of the quantum field theory; an alternative formulation may well be required in order to find a proper understanding of the conjectured S-matrices and other features such as the mass-renormalization and the Clebsch-Gordan property. Certainly, the knowledge from other approaches, for example, the Quantum Group approach to imaginary coupling ATFT, investigations of the Bethe-Salpeter equations for the bound states in ATFT and the algebraic Bethe ansatz method advocated for many years by Faddeev and others would be helpful in the search for such a re-formulation. (J.P.N.).

7899 (YITP/U–91-5) **Note on 3-dimensional Regge calculus.** Soda, Jiro (Hiroshima Univ. (Japan). Dept. of Physics). Kyoto Univ., Uji (Japan). Yukawa Inst. for Theoretical Physics. Jan 1991. 13p. Order Number DE92750829. Source: OSTI; NTIS (US Sales Only); INIS.

We shall study 3-dimensional Regge calculus with concentrating the role of the Bianchi identity. As a result, the number of the physical variables is determined to be 12g - 12(g > 1). The reason why Rocek and Williams derived the exact result of Deser, Jackiw and 'tHooft is clarified. (author).

7900 (YITP/U–91-06) **Gauge symmetries in extended objects.** Fujikawa, Kazuo. Kyoto Univ., Uji (Japan). Yukawa Inst. for

Theoretical Physics. Jan 1991. 14p. Order Number DE92750830. Source: OSTI; NTIS (US Sales Only); INIS.

Some general aspects of p-dimensionally extended objects (p-branes) described by the Nambu-Goto action are discussed. The physical meaning of a large number of gauge degrees of freedom inherent in the Lagrangian is examined. The potential instability of relativistic balls (p=3) and membranes (p=2) is explained, and a possible stabilizing mechanism of these objects is discussed. (author).

7901 (YITP/U-91-7) **Conformal field theoretical approach to two-dimensional quantum gravity.** Suzuki, Hiroshi (Hiroshima Univ. (Japan). Dept. of Physics). Kyoto Univ., Uji (Japan). Yukawa Inst. for Theoretical Physics. Jan 1991. 35p. Order Number DE92750831. Source: OSTI; NTIS (US Sales Only); INIS.

A conformal (or Weyl) mode of two-dimensional gravity coupled to conformally invariant matter, which is a gauge degree of freedom in the classical level, becomes dynamical through the conformal (or Weyl) anomaly. We consider the BRS quantization of the above system in the conformal gauge. As a practical approach which enables us to do explicit calculations, we reduce the BRS invariant path integral measure for the conformal mode to the naive one by including a one-loop renormalization effect. Since the two-dimensional metric is locally conformally flat, the resulting effective theory is constructed in a flat space-time. We also construct tensorial operators (BRS, ghost number current and the energy momentum tensor) in the effective theory in a flat space-time based on anomalous Ward identities, i.e., trace, BRS and ghost number anomalies. Then we show that the effective theory has desired properties by calculating the operator product expansions. For example, we see that the total central charge of the Virasoro algebra vanishes. Our result forms a basis of a conformal field theoretical approach to two-dimensional quantum gravity and it has applications to a theory of non-critical strings. (author).

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Refer also to citation(s) 7877, 7878, 7887, 7888, 7889, 7890, 7892, 7936, 7939, 7941, 7943, 7959, 7963, 7965, 7969, 7973

7902 (BNL-46862) **Hadron spectroscopy and B physics at RHIC.** Chung, S.U.; Weygand, D.P.; Willutzki, H.J. Brookhaven National Lab., Upton, NY (United States). Nov 1991. 20p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE92005038. Source: OSTI; NTIS; INIS; GPO Dep.

A description is given of the physics opportunities at RHIC regarding quark-gluon spectroscopy. The basic idea is to isolate with appropriate triggers the sub-processes pomeron + pomeron → hadrons and $\gamma^* + \gamma^* \rightarrow$ hadrons with the net effective mass of hadrons in the range of 1.0 to 10.0 GeV, in order to study the hadronic states composed of quarks and gluons. The double-pomeron interactions are expected to produce glueballs and hybrids preferentially, while the two-offshell-photon initial states should couple predominantly to quarkonia and multiquark states. Of particular interest is the possibility of carrying out a CP-violation study in the self-tagging B decays, $B_d^0 \rightarrow K^+\pi^-$ and $\bar{B}_d^0 \rightarrow K^-\pi^+$. 20 refs., 4 figs.

7903 (CONF-9110317-1) **Numerical implementation of the Dirac equation on hypercube multicomputers.** Wells, J.C. (Oak Ridge National Lab., TN (United States)); Umar, A.S.; Oberacker, V.E.; Bottcher; Strayer, M.R.; Wu, J.S.; Drake, J.; Flanery, F. Oak Ridge National Lab., TN (United States). [1991]. 31p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From International supercomputer users group meeting; Dallas, TX (United States); 7-9 Oct 1991. Order Number DE92005128. Source: OSTI; NTIS; INIS; GPO Dep.

Motivated by an interest in nonperturbative electromagnetic lepton-pair production in relativistic heavy-ion collisions, we discuss the numerical methods used in implementing a lattice solution of the time-dependent Dirac equation in three-dimensional Cartesian coordinates. Discretization is obtained using the lattice basis-spline collocation method, in which quantum-state vectors and coordinate-space operators are expressed in terms of basis-spline functions, and represented on a spatial lattice. All numerical procedures reduce to a series of matrix-vector operations which we perform on the Intel iPSC/860 hypercube multicomputer. We discuss solutions to the problems of limited node memory and node-to-node communication overhead inherent in using distributed-memory, multiple-instruction, multiple-data parallel computers.

7904 (DESY-91-074) **High-energy behaviour in a non-abelian gauge theory. Pt. 3. Multiple discontinuities and particle → multireggeon vertices.** Bartels, J. (Hamburg Univ. (Germany). 2. Inst. fuer Theoretische Physik). Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Jul 1991. 66p. Order Number DE92758901. Source: OSTI; NTIS (US Sales Only); INIS.

The high energy limit (Regge limit) of a spontaneously broken SU(2) gauge theory is studied beyond the leading-lns approximation. Calculations are based upon the analytic structure of scattering amplitudes in generalized Regge limits, and the resulting amplitudes satisfy reggeon unitarity in the t-channel as well as unitarity in the s-channel. The calculations lead to a systematic construction of a reggeon field theory. (orig.).

7905 (DOE/ER/40427-30-N91) **Relativistic projection and boost of solitons.** Wilets, L. Washington Univ., Seattle, WA (United States). Dept. of Physics. [1991]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-88ER40427. (CONF-9108186-1: Relativistic aspects of nuclear physics, Rio de Janeiro (Brazil), 2-30 Aug 1991). Order Number DE92004273. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the following topics on the relativistic projection and boost of solitons: The center of mass problem; momentum eigenstates; variation after projection; and the nucleon as a composite. (LSP).

7906 (DOE/ER/40448-4) **Theoretical aspects of electroweak and other interactions in medium energy nuclear physics: Progress report.** Mukhopadhyay, N.C. Rensselaer Polytechnic Inst., Troy, NY (United States). Dept. of Physics. 4 Dec 1991. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER40448. Order Number DE92004490. Source: OSTI; NTIS; INIS; GPO Dep.

In the project under review, progress has been made on the problem of dynamic symmetries exhibited by mesons as color strings. A novel property of the vibrational states of heavy mesons, that of an approximate saturation of a particular spectroscopic interval, has been found as a "fingerprint" for linear quark confinement potentials. Progress has been continued in the study of electroweak excitation of the baryon resonances, including the use of Compton scattering.

7907 (DOE/ER/40561-16) **Relativistic meson-exchange currents in the dip region.** Dekker, M.J. (Rijksuniversiteit Utrecht (Netherlands). Robert van de Graaff Lab.); Brussaard, P.J.; Tjon, J.A. Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory. [1991]. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-90ER40561. Order Number DE92004369. Source: OSTI; NTIS; INIS; GPO Dep.

We show that a relativistic treatment of meson exchange currents for inclusive electron scattering off a nucleus treated as a free Fermi gas leads to a strong enhancement of the transverse response function in the dip region in the two-particle knockout channel, mainly through the intermediate δ(1232)-excitation. This suggests that the missing strength in the dip region can, at least partially, be accounted for by a relativistic treatment of the δ(1232)-excitation and its coupling to the two-nucleon system. Recoil effects are found to be sizable over the whole range of energy transfer including the quasi-elastic peak. 18 refs., 3 figs.

7908 (DOE/ER/40561-22) **Structure and dynamical nature of hot and dense QCD matter.** Hatsuda, Tetsuo. Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory. Jul 1991. 20p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-90ER40561. (CONF-9106274-5: Symposium on high energy nuclear collisions and quark gluon plasma, Kyoto (Japan), 6-8 Jun 1991). Order Number DE92004375. Source: OSTI; NTIS; INIS; GPO Dep.

Static and dynamical properties of QCD at finite temperature and density are reviewed. Non-perturbative aspects of the QCD plasma and the modification of the hadron properties associated with the chiral transition are discussed on the basis of lattice data, effective theories and QCD sum rules. Special emphasis is laid on the importance of the finite baryon density to see the effects of the restoration of chiral symmetry in experiment.

7909 (DOE/ER/40561–23) **Simulating NJL-mechanism with realistic vector-type confining Lagrangian.** Mitra, A.N. (Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory); Mitra, B. Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory. [1991]. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-90ER40561. Order Number DE92004376. Source: OSTI; NTIS; INIS; GPO Dep.

The concrete possibilities for a realistic simulation of the Nambu-Jona Lasino mechanism of dynamical mass generation are examined from the view-point of a Vector-type confining form of 4-fermion Lagrangian with a natural mass scale which substitutes for the canonical NJL-model of contact interaction, and is designed to keep a conscious link with spectroscopy. Such Lagrangians are known to lead (through the minimality condition on the effective Action) to both the Schwinger-Dyson and Bethe-Salpeter equations for the quark-mass operation $\Sigma(\rho)$ and the hadron-quark vertex function $F_H(q,P)$ respectively. With a choice of the interactions which corresponds to a Lorentz-covariant generalization of the familiar instantaneous approximation, the related Bethe-Salpeter equation already provides a good description of both $q\bar{q}$ and qqq spectra, as well a Lorentz covariant access to different types of transition amplitudes via quark loops, within a common dynamical framework. With this pre-calabration, the model is subjected to the interlinked SDE and BSE for testing some key aspects of the NJL-self consistency mechanism by evaluating some basic constants. The results are: m_{NJL} = 300 Mev, $M_\pi^2 \sim m_c$; M_σ = 857 Mev; $[q\bar{q}]_0$ = (219 mev)^3. From these values two independent estimates of m_c are found as 21.8 and 17.8 (Mev).

7910 (DOE/ER/40561–25) **Perturbative QCD signatures of hybrid hadrons in electroproduction at high Q^2.** Carlson, C.E. (Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory); Mukhopadhyay, N.C. Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory. Aug 1991. 12p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract FG06-90ER40561. Grant PHY-9112173. (WM–91-109;RPI–N76-91). Order Number DE92004378. Source: OSTI; NTIS; INIS; GPO Dep.

In the perturbative domain of quantum chromodynamics (QCD), transverse electroproduction of hybrid baryons is small. Their longitudinal electroproduction has size and scaling behavior like normal baryons. Thus deep inelastic scattering has hybrid resonance peak to background ratio small for the transverse structure function but normal size and constant for the longitudinal one. This signature can test if the Roper resonance is a hybrid. Related high momentum transfer signatures may clarify the structure of possible non-standard states such as $\Lambda(1405)$, $f_0(975)$, or $a_0(980)$.

7911 (DOE/ER/40561–26) **Nucleon-antinucleon annihilation in chiral soliton model.** Musakhanov, M.M. (Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory); Musatov, I.V. Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory. 7 Sep 1991. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-90ER40561. Order Number DE92004379. Source: OSTI; NTIS; INIS; GPO Dep.

We investigate annihilation process of nucleons in the chiral soliton model by the path integral method. A soliton-antisoliton pair is shown to decay into mesons at range of about 1fm, defined by the $S\bar{S}$ potential. Contribution of the annihilation channel to the elastic scattering is discussed.

7912 (DOE/ER/40561–28) **Chiral perturbation theory with nucleons.** Meissner, U.G. Bern Univ. (Switzerland). Inst. fuer Theoretische Physik; Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory. Sep 1991. 40p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-90ER40561. Order Number DE92004383. Source: OSTI; NTIS; INIS; GPO Dep.

I review the constraints posed on the interactions of pions, nucleons and photons by the spontaneously broken chiral symmetry of QCD. The framework to perform these calculations, chiral perturbation theory, is briefly discussed in the meson sector. The method is a simultaneous expansion of the Greens functions in powers of external moments and quark masses around the massless case, the chiral limit. To perform this expansion, use is made of a phenomenological Lagrangian which encodes the Ward-identities and pertinent symmetries of QCD. The concept of chiral power counting is introduced. The main part of the lectures of consists in describing how to include baryons (nucleons) and how the chiral structure is modified by the fact that the nucleon mass in the chiral limit does not vanish. Particular emphasis is put on working out applications to show the strengths and limitations of the methods. Some processes which are discussed are threshold photopion production, low-energy compton scattering off nucleons, πN scattering and the σ-term. The implications of the broken chiral symmetry on the nuclear forces are briefly described. An alternative approach, in which the baryons are treated as very heavy fields, is touched upon.

7913 (DOE/ER/40561–31) **Segregation of quarks within the neutron.** Dziembowski, Z. Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory. [1991]. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-90ER40561. Order Number DE92004386. Source: OSTI; NTIS; INIS; GPO Dep.

Measurements of the nucleon form factor and structure function seem to indicate an inhomogeneous distribution of flavor, charge and spin within the nucleon. It is argued that the ordinary three-quark model with a spin-spin force of the type suggested by QCD can explain the inhomogeneity as seen at different resolutions. This agreement suggests a specific bound quark picture of the nucleon structure with a positive core of u and d quarks in a spin-O state of ms radius 0.17 ± 0.01 fm^2 and an outer layer of a linear size ~ 1 fm where the polarized u (in the proton) or d (in the neutron) is orbiting. 21 refs., 3 figs.

7914 (DOE/ER/40561–32) **Soft modes associated with chiral transition in hot QCD.** Hatsuda, Tetsuo. Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory. Oct 1991. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-90ER40561. (CONF-910898–1: Hot summer daze: quantum chromodynamics at finite temperature and density, Upton, NY (United States), 6-17 Aug 1991). Order Number DE92004387. Source: OSTI; NTIS; INIS; GPO Dep.

Fluctuations of the chiral order parameter in a hot and/or dense QCD plasma is discussed. If the transition is of second order or weak first order, the fluctuation gets large strength with small width and behaves as a bosonic quasi-particle in the plasma. This was first pointed out by Kunihiro and the present author on 1985 and was called "soft mode". General properties of the soft mode and its relation to the recent measurement of the hadronic screening length on the lattice are discussed in this report.

7915 (DOE/ER/40561–33) **Chiral symmetry, axial anomaly and the structure of hot QCD.** Hatsuda, Tetsuo. Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory. Oct 1991. 48p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-90ER40561. Order Number DE92004389. Source: OSTI; NTIS; INIS; GPO Dep.

Lecture given at "Winter meeting on intermediate energy nuclear physics" (Mt. Sorak, Korea, February 26–March 1, 1991).

This lecture is composed of three parts. [I] Heavy quark and gluon contents of light hadrons, [II] anomalous gluon content of the nucleon, and [III] hot and dense QCD. Non-valence structures of nucleon due to the OZI violation are extensively discussed in [I] and [II], and non-perturbative aspects of the quark-gluon plasma are reviewed in [III]. 41 refs.

7916 (DOE/ER/40614–10) **QCD based static potential between heavy quarks.** Baker, M. (Washington Univ., Seattle, WA (United States). Dept. of Physics); Ball, J.S.; Zachriasen, R. Washington Univ., Seattle, WA (United States). Dept. of Physics. [1991]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-91ER40614. (CALT–68-1744;CONF-910881–28: Particles and fields '91, Vancouver (Canada), 18-22 Aug 1991). Order Number DE92004266. Source: OSTI; NTIS; INIS; GPO Dep.

We calculate the static potential between a quark-anti quark pair using dual potentials to describe long-distance Yang-Mills theory.

7917 (FNAL/C–91/281) **Physics requirements for LHC/SSC calorimetry.** Green, D. Fermi National Accelerator Lab., Batavia, IL (United States). Oct 1991. 33p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-9110281–1: Calorimetry and high energy physics conference, Capri (Italy), 14-18 Oct 1991). Order Number DE92003054. Source: OSTI; NTIS; INIS; GPO Dep.

The goal of the next generation of collider detectors is to study the origin of electroweak symmetry breaking. The mass scale for this study is roughly 1 TeV. No matter what the details of the mechanism, one can be confident that new phenomena will occur, since weak interactions become strong, i.e., violate partial wave unitarity, at that mass scale. The partial wave amplitude for ee→ WW scattering is; $ao \sim 4\phi/\alpha_w(M_w/M)^2$, $ao \sim 1$ if $M \sim 1$ TeV. Therefore, the detectors for LHC/SSC must be able to confront this mass scale. In particular, the electroweak dynamics is such that the study of gauge boson pairs has a high priority. Given that the simplest decay modes for gauge boson are into leptons, the new detectors will naturally tend to optimize performance for leptons.

7918 (IC–91/152) **QCD analysis of deep inelastic lepton-nucleon scattering data.** Bilenkaya, S.I. (Joint Inst. for Nuclear Research, Dubna (USSR)); Stamenov, D.B. International Centre for Theoretical Physics, Trieste (Italy). Jun 1991. 13p. Order Number DE92609862. Source: OSTI; NTIS (US Sales Only); INIS.

A combined next-to-leading order QCD analysis of BCDMS $\mu H_2(D_2)$ and CDHS $\nu(\nu\text{-bar})H_2$ scattering data is presented. The nucleon structure functions are given in terms of parton distributions. Unlike most of the papers on this subject, the cross-section scattering data (not the values for the nucleon structure functions extracted from these data by additional extrapolations and assumptions) are fitted. A very good agreement of the data with the predictions of QCD for the parton distributions is observed. The QCD mass scale parameter Λ is determined form these data both in a flavour nonsinglet approximation and with a complete flavour singlet and non-singlet treatment. These two fits to the data give consistent results for Λ. (author). 16 refs, 2 tabs.

7919 (IC–91/268) **Thermodynamics of a deformed bag and quark-gluon deconfinement phase transition.** Ansari, A. (International Centre for Theoretical Physics, Trieste (Italy)); Mustafa, M.G. International Centre for Theoretical Physics, Trieste (Italy). Aug 1991. 22p. Order Number DE92614197. Source: OSTI; NTIS (US Sales Only); INIS.

Constructing a colour singlet partition function for a finite size deformable bag, the thermodynamic properties of quarks (two flavours) and gluons are studied with the chemical potential $\mu \neq 0$ under the constraint that the baryon number, b = 1. The transition temperature, T_S in the large volume limit as well as the critical temperature, $T_C > T_S$, beyond which hadrons cease to exist, both are found to decrease with the increase of deformation, presently a spheroidal shape being considered. The difference $T_C - T_S \approx 20$ MeV, which arises mainly due to the restriction to the colour singlet states, remains more or less deformation independent. Thus, a region of superheated (supercooled) metastable states in the temperature range $T_S < T < T_C$ in the μ - T exists even for deformed hadrons with the values of T_S and T_C somewhat reduced. (author). 28 refs, 3 figs, 1 tab.

7920 (IC–91/290) **On the Q-Q channel interaction of the effective NJL-Hamiltonian.** Ansari, A. International Centre for Theoretical Physics, Trieste (Italy). Sep 1991. 11p. Order Number DE92614198. Source: OSTI; NTIS (US Sales Only); INIS.

We take the usual simple form of the Nambu-Jona-Lasinio (NJL) Hamiltonian containing only the scalar and pseudoscalar terms with two flavours of massless quarks (u and d). Then making the interaction strength position dependent, as done by Bernard et al., to bringing confinement, we calculate the nucleon (N) and delta (Δ) masses. In this simple form the interaction seems not to contain enough spin-isospin dependence to yield a reasonable value of N - Δ mass difference. The raises doubts if the NJL interaction, in its simple form, can be employed to study the spectroscopic properties of hadrons. (author). 13 refs, 1 fig., 2 tabs.

7921 (JINR-E–2-90-196) **Extra Z' boson and top quark mass.** Bednyakov, V.A. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems. 1990. 8p. Order Number DE92609713. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Phys. Lett., B.

The inclusion of the extra Z' boson decreases the top quark mass determined from the radiative corrections. For instance, m_t can decrease from 130 GeV to 85 GeV for some permissible values of the Z' boson parameters. 11 refs.; 2 figs.; 1 tab.

7922 (JINR-E–2-90-414) **Instantaneous approximation for QCD and the properties of mesons (π,π',K,K').** Amirkhanov, I.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics); Pervushin, V.N.; Puzynin, I.V.; Zhuraev, O.M.; Sarikov, N.A. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics. 1990. 10p. Order Number DE92609747. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Modern Physics Letters.

The paper is devoted to the QCD-calculation of constituent u, d, s-quark masses, nonlocal condensate, π, π', K, K'-mesons masses, their wave functions and the decay constants in the supposition of the dominance of the instantaneous gluon interaction defined from the J/ψ-spectroscopy. The approach gives the unified description of meson spectroscopy and their radial excitations excitations for arbitrary mass and current quarks. 14 refs.; 6 figs.; 1 tab.

7923 (LBL–31274) **Electroweak phase transitions.** Anderson, G.W. Lawrence Berkeley Lab., CA (United States). 16 Sep 1991. 69p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract AC03-76SF00098. Grant PHY90-21139. (UCB-PTH–91/46). Order Number DE92004177. Source: OSTI; NTIS; INIS; GPO Dep.

An analytic treatment of the one Higgs doublet, electroweak phase transition is given. The phase transition is first order, occurs by the nucleation of thin walled bubbles and completes at a temperature where the order parameter, $\langle\phi\rangle_T$ is significantly smaller than it is when the origin becomes absolutely unstable. The rate of anomalous baryon number violation is an exponentially function of $\langle\phi\rangle_T$. In very minimal extensions of the standard model it is quite easy to increase $\langle\phi\rangle_T$ so that anomalous baryon number violation is suppressed after completion of the phase transition. Hence baryogenesis at the electroweak phase transition is tenable in minimal of the standard model. In some cases additional phase transitions are possible. For a light Higgs boson, when the top quark mass is sufficiently large, the state where the Higgs field has a vacuum expectation value $\langle\phi\rangle = 246$ GeV is not the true minimum of the Higgs potential. When this is the case, and when the top quark mass exceeds some critical value, thermal fluctuations in the early universe would have rendered the state $\langle\phi\rangle = 246$ GeV unstable. The requirement that the state $\langle\phi\rangle = 246$ GeV is sufficiently long lived constrains the masses of the Higgs boson and the top quark. Finally, we consider whether local phase transitions can be induced by heavy particles which act as seeds for deformations in the scalar field.

7924 (NIKHEF-H–91-13) **On the existence of a new constrained instanton and high-energy electroweak interactions.** Klinkhamer, F.R. (CHEAF, Amsterdam (Netherlands)). Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H. Jun 1991. 27p. Order Number DE92614181. Source: OSTI; NTIS (US Sales Only); INIS.

The authors construct, in the SU(2) Yang-Mills-Higgs theory of the electroweak interactions, a non-contractible loop of 4-dimensional configurations. Numerical results for the action over the loop show the existence of a new constrained instanton I^* with action $\approx 16\pi^2/g^2$ and zero topological charge. They also discuss the spectral flow of the Dirac operator along the loop and I^* is expected to have fermion-zero modes. As a possible application the total B+L violating cross-section is considered, evaluated semiclassically from the imaginary part of the forward elastic scattering amplitude. The numerical results for I^* indicate a threshold-like behaviour for non-perturbative effects at a parton center-of-mass energy close to the sphaleron energy $E_S \approx 10$ TeV. (author). 31 refs.; 9 figs.

7925 (NIKHEF-H–91-17) **Two-loop QCD corrections to the coefficient functions of the deep inelastic structure functions**

F_2 and F_L. Larin, S.A. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H); Vermaseren, J.A.M. Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H. 1991. 11p. Order Number DE92614188. Source: OSTI; NTIS (US Sales Only); INIS.

The authors present the analytic two-loop perturbative QCD corrections in the leading twist approximation to the coefficient functions of the operator product expansion for the second to tenth moments of the nonsinglet and singlet deep inelastic structure functions F_2 and F_L. (author). 22 refs.

7926 (NIKHEF-H–91-19) **The $O(\alpha_S{}^3)$ QCD correction to the lowest moment of the longitudinal structure function in deep inelastic electron-nucleon scattering.** Larin, S.A. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H); Tkachov, F.V. Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H. 1991. 9p. Order Number DE92614182. Source: OSTI; NTIS (US Sales Only); INIS.

The authors present the analytic leading-twist three-loop perturbative QCD correction to the moment $\int 0^1 dx F_L{}^{p-n}(x,Q^2)$ of the non-singlet longitudinal structure function F_L of the deep inelastic electron-nucleon scattering. It provides quantitative information on uncertainties of pQCD predictions for $D(x,Q^2)$ $\sigma_l/\sigma/T$. (author). 24 refs.; 2 figs.

7927 (NIKHEF-H–91-22) **Rescattering in ν/ν-bar-deuteron reactions.** Tenner, A.G. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H); Nikolaev, N.N. Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H. Aug 1991. 26p. Order Number DE92614183. Source: OSTI; NTIS (US Sales Only); INIS.

A study is made of the rescattering phenomenon in the deuteron by means of the analysis of ν/ν-bar-d interactions. Values are presented of the rescattering fraction in dependence on various para-meters. The charged and negative hadron multiplicities of rescatter and non-rescatter events are evaluated. A special study is made of strange particle events. Production rates of specific particles (e.g. negative, strange) are compared for rescattering and non-rescattering reactions in their dependence on rapidity. The rescattering data are analyzed in the framework of the formation time formalism. The proper time of hadronization T_f is evaluated to be ≈ 0.5 fm/c. The authors' analysis of νd scattering is directly relevant to the issue of the quark-gluon plasma formation in heavy-ion collisions. Some differences between the neutrino and hadron induced rescatters in a deuteron can be attributed to the constituent quark structure of nucleons. The observed enhancement of Λ production in the rescatter events suggests that hadronic reinteraction mechanisms may obscure strangeness enhancement as a signature of the quark-gluon plasma formation in the heavy-ion collisions. The possible reduction of formation time in low multiplicity events is discussed. (author). 40 refs.; 8 figs.; 3 tabs.

7928 (NIKHEF-H–91-24) **Non-perturbative effects in high-energy electroweak interactions.** Klinkhamer, F.R. (Centrum voor Hoge-Energie-Astro-Fysica, Amsterdam (Netherlands)). Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H. Oct 1991. 6p. (CONF-9107172–: 15. joint international lepton photon symposium at high energies and European Physical Society (EPS) conference on high energy, Geneva (Switzerland), 25 Jul - 1 aug 1991). Order Number DE92614184. Source: OSTI; NTIS (US Sales Only); INIS.

To be published in the Proceedings of the Joint international Lepton-photon symposium and Europhysics conference on high energy physics, Geneva, Switzerland, 1991.

A semiclassical calculation shows threshold-like behaviour for non-perturbative electroweak effects at a parton center-of-mass energy close to the sphaleron energy $E_S \approx 10$ TeV. (author). 22 refs.; 3 figs.

6623 Specific Interactions, Decays and Processes

Refer also to citation(s) 7254, 7408, 7412, 7902, 7906, 7907, 7911, 7918, 7964, 7969, 7971, 7975, 7993, 7994, 8056, 8110, 8121

7929 (ANL-HEP-CP–91-95) **Review of total cross sections and forward scattering parameters at ultra-high energies.** Block, M.M. (Northwestern Univ., Evanston, IL (United States). Dept. of Physics and Astronomy); White, A.R. Argonne National Lab., IL (United States). High Energy Physics Div. Oct 1991. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38 ;AC02-76ER02289. (CONF-9109221–1: 21. international symposium on multiparticle dynamics, Wuhan (China), 23-27 Sep 1991). Order Number DE92004153. Source: OSTI; NTIS; INIS; GPO Dep.

We review the field of the elastic scattering of pp and $\bar{p}$p at the ultra-high energies. The recent total cross section, σ_{tot}, and ρ-value results from the Fermilab Tevatron Collider experiments presented at the 4th 'Blois' Workshop on Elastic and Diffractive Scattering (Elba, Italy, in May, 1991), allow us a comprehensive overview of the field. 24 refs., 10 figs., 3 tabs.

7930 (BNL–46819) **Status of the Oα calculation of $e^+e^- \rightarrow W^+W^- \rightarrow$ 4f(gamma).** Aeppli, A. Brookhaven National Lab., Upton, NY (United States). Nov 1991. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-9109328–1: Physics with e^+e^- linear colliders, Hamburg (Germany), 2-4 Sep 1991). Order Number DE92005040. Source: OSTI; NTIS; INIS; GPO Dep.

We consider the full process $e^+e^- \rightarrow W^+W^- \rightarrow 4f$. We show that the off-shell effect are sizable and comparable to radiative effects. We give the exact results for hard bremsstrahlung processes $e^+e^- \rightarrow (4f + \gamma)$ and the results of the $O(\alpha)$ improved cross sections for $e^+e^- \rightarrow W^+W^-$ including photon radiation. The status of the virtual corrections to the 4f-process is described.

7931 (BNL–46890) **Lattice calculation of nonleptonic charm decays.** Simone, J.N. Brookhaven National Lab., Upton, NY (United States). Nov 1991. 201p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE92005026. Source: OSTI; NTIS; INIS; GPO Dep.

Thesis submitted to the Univ. of California, Los Angeles.

The decays of charmed mesons into two body nonleptonic final states are investigated. Weak interaction amplitudes of interest in these decays are extracted from lattice four-point correlation functions using a effective weak Hamiltonian including effects to order G_f in the weak interactions yet containing effects to all orders in the strong interactions. The lattice calculation allows a quantitative examination of non-spectator processes in charm decays helping to elucidate the role of effects such as color coherence, final state interactions and the importance of the so called weak annihilation process. For $D \rightarrow K\pi$, we find that the non-spectator weak annihilation diagram is not small, and we interpret this as evidence for large final state interactions. Moreover, there is indications of a resonance in the isospin $\frac{1}{2}$ channel to which the weak annihilation process contributes exclusively. Findings from the lattice calculation are compared to results from the continuum vacuum saturation approximation and amplitudes are examined within the framework of the 1/N expansion. Factorization and the vacuum saturation approximation are tested for lattice amplitudes by comparing amplitudes extracted from lattice four-point functions with the same amplitude extracted from products of two-point and three-point lattice correlation functions arising out of factorization and vacuum saturation.

7932 (BONN-IR–91-57) **Measurement of the differential cross section of the reaction $\gamma p \rightarrow \pi^+ n$ at the energy-tagged photon beam of the PHOENICS experiment.** Buechler, K. Bonn Univ. (Germany). Physikalisches Inst.; Bonn Univ. (Germany). Mathematisch-Naturwissenschaftliche Fakultaet. Oct 1991. 65p. (In German). Order Number DE92759318. Source: OSTI; NTIS (US Sales Only); INIS.

At the Bonn Electron Strecherring ELSA the differential cross section for the reaction $\gamma p \rightarrow \pi^+ n$ was measured. The measurement was performed with the PHOENICS detector, which consists of a bremsstrahlung tagging system and a hadron detector with large angular acceptance. The experiment covered a kinematic region of 210 MeV $\leq E_\gamma \leq$ 960 MeV and 35deg $< \Theta_{\pi,\ \mathrm{CMS}} \leq$ 135deg. The data are in good agreement with other experiments. They are also compared with the results of a recent partial wave analysis and with the predictions of a constituent quark model in the first resonance region. (orig.).

7933 (CONF-900822–33) **Measurement of the J/Ψ elastic photoproduction from 100 GeV to 400 GeV in the experiment E687 at Fermilab.** Ratti, S.P. (Pavia Univ. (Italy). Dipt. di Fisica Nucleare e Teorica). E687 Collaboration. Northwestern Univ., Evanston, IL (United States). [1990]. 23p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76ER02289. From 25. IUPAP international conference on high energy physics; Singapore (Singapore); 2-8 Aug 1990. Order Number DE92004290. Source: OSTI; NTIS; INIS; GPO Dep.

In the present paper we give the experimental measurement of the cross section per nucleon for the elastic J/ψ photoproduction in six energy intervals from 100 GeV to 450 GeV; the overall dσ/dt differential cross section, as well as an estimate of the coherent diffractive photoproduction off the Be nucleus. We will finally compare the energy dependence of our measured cross sections with the predictions of the PGF Model.

7934 (CONF-901145–2) **Proton-proton and proton-antiproton elastic scattering at high energies: Theory, phenomenology, and experiment.** Wu, Tai Tsun. Harvard Univ., Cambridge, MA (United States). Gordon McKay Lab. [1990]. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-84ER40158. From Beyond the standard model II - a critical review of the standard model and the prospects for discovering new physics; Norman, OK (United States); 1-3 Nov 1990. Order Number DE92004414. Source: OSTI; NTIS; INIS; GPO Dep.

This is a brief review of the progress in the understanding, during the past twenty years, of hadronic elastic scattering near the forward direction at high energies. On the basis of quantum gauge field theories, the Pomeron is found to be a branch cut above 1. Using the physical picture that this result implies, phenomenology for proton-proton and antiproton-proton elastic scattering is constructed. Two noteworthy features are that, at high energies, both the total cross section and the ratio of the integrated elastic cross section to the total cross section to the total cross section are increasing functions of the center-of-mass energy. Detailed predictions are given for the elastic differential cross sections, Coulomb interference and the ratios of the real to imaginary parts of the forward amplitudes. These predictions have been extensively and accurately confirmed by experiments, and have also been given both for future experiments on existing accelerators and for experiments on future accelerators. 14 refs., 2 figs.

7935 (CONF-9105106–34) **Fluctuations and correlations in 200A GeV A-A collisions.** Wilkes, R.J. EMU01 Collaboration. Washington Univ., Seattle, WA (United States). Visual Techniques Lab. [1991]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-91ER40614. (UWSEA-PUB–91-10). From Conference on the intersections between particle and nuclear physics; Tucson, AZ (United States); 23-29 May 1991. Order Number DE92004381. Source: OSTI; NTIS; INIS; GPO Dep.

Factorial cumulant moments are used to analyze pseudorapidity fluctuations in A-A interactions. Only the second cumulant moments are significantly non-zero for central event samples, which implies that the higher order scaled factorial moments for the central data provide little information in addition to that from the second moments. The slopes of the cumulant plots are found to be inversely proportional to η density for a variety of beam/target/energy combinations. We also present results on 2-D scaled factorial moments and the 2-particle correlations for central S+Au interactions.

7936 (DESY–91-078) **QCD corrections to final state photon bremsstrahlung in e^+e^- annihilation.** Kramer, G. (Hamburg Univ. (Germany). 2. Inst. fuer Theoretische Physik); Lampe, B. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Jul 1991. 20p. Contract BMFT 055HH91P(8). Order Number DE92758900. Source: OSTI; NTIS (US Sales Only); INIS.

We calculate the partial widths of the decay Z into one photon plus n-jets (n = 1, 2, 3) as a function of the invariant mass cut parameter $y = {}^{m_{ij}2}/m_Z{}^2$ where m_{ij} is the minimum jet invariant mass. Our calculation uses fixed order QCD perturbation theory up to $O(\alpha_s)$. Results in two schemes for defining jet variables are presented. (orig.).

7937 (DESY–91-080) **Rare decays of B-mesons.** Ali, A. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Jul 1991. 20p. (CONF-9105177–: 1. international A.D. Sakharov conference on physics, Moscow (USSR), 27-31 May 1991). Order Number DE92758903. Source: OSTI; NTIS (US Sales Only); INIS.

This paper is organized as follows. First, we discuss the decay rates for b → (s,d) + γ in the lowest order (1 loop) and including the QCD corrections in the effective Hamiltonian method. The photon energy spectrum in the inclusive decays $B \to X_s + \gamma$ is evaluated in this approach and the dominant background from the CC decays $B \to X_c + \gamma$ is presented. Next, we discuss the calculations for the inclusive decays b → s + anti l (l = e,μ,ν), including the QCD corrections. Finally, we summarize rate estimates for the exclusive rare decays of the B-meson, $B \to K^*\gamma$, and B → (K,K*) anti l (l = e,μ,ν), as well as $B^o{}_{s,d} \to \gamma\gamma$ and $B^o{}_{s,d} \to l^+l^-$ with (l = e,μ,r). (orig./HSI).

7938 (DESY–91-085) **Associate J/ψ + γ production: A clean probe of gluon densities.** Drees, M. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Gruppe Theorie); Kim, C.S. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Aug 1991. 21p. Order Number DE92758899. Source: OSTI; NTIS (US Sales Only); INIS.

We discuss the associate production of a J/Ψ meson and a photon at panti p (or pp) and ep colliders. By requiring the J/Ψ to decay into an e^+e^- or $\mu^+\mu^-$ pair, we end up with an exceptionally clean final state. Furthermore, in leading order it can only be produced via gluon fusion. This process can therefore serve as a very clean probe of the gluon densities inside the proton as well as the photon. Numerical results are presented for the Tevatron panti p and HERA ep colliders. (orig.).

7939 (DOE/ER/40158–9) **The theory of High Energy Collision Processes: Annual technical progress report, January 1, 1991–December 31, 1991.** Wu, T.T. Harvard Univ., Cambridge, MA (United States). Div. of Applied Sciences. 29 Nov 1991. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-84ER40158. Order Number DE92004415. Source: OSTI; NTIS; INIS; GPO Dep.

This report briefly discusses research in proton-antiproton interactions and the standard model. (LSP)

7940 (DOE/ER/40389–71) **Experimental investigations in particle physics at intermediate energies: Performance report for December 1, 1990–November 30, 1991.** Auerbach, L.B.; Highland, V.L.; Martoff, C.J.; McFarlane, K.W.; Guss, C.; Kettell, S. Temple Univ., Philadelphia, PA (United States). Dept. of Physics. 30 Sep 1991. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER40389. Order Number DE92005081. Source: OSTI; NTIS; INIS; GPO Dep.

The major elements of this project continues to be on fundamental symmetries and parameters of the Standard Model. The projects in the current period have been BNL E791 (a search for the decay $K_L{}^0 \to \mu e$, which would violate the rule of separate lepton number conservation), test of an upgrade proposal (E871), and LSND, a neutrino experiment at LAMPF. For E791, data taking was completed in June 1990, and preliminary results are now available for the decays $K_L{}^0 \to \mu e$ and $K_L{}^0 \to \mu\mu$from the entire data set. The data for decay $K_L{}^0 \to ee$ are still being analysed. These are an upper limit for the branching fraction for $K_L{}^0 \to \mu e$ of 3.5×10^{-11} (90% C.L.). From the 1990 data alone, we have a new (preliminary) value of the branching fraction for $K_L{}^0 \to \mu\mu$ of $(6.96\pm0.\ 4\pm0.22) \times 10^{-9}$, with a sample of 349 events. Combining this with earlier data gives $(6.96\pm0.34) \times 10^9$, by far the most precise value. The limit on the decay $K_L{}^0 \to \mu e$ places a lower limit on the mass of a new particle mediating such decays of 85 TeV. The LSND (Large Scintillator Neutrino Detector), a search for neutrino oscillations at LAMPF, has been approved, and is now underway. Other neutrino work at Los Alamos, E764, has resulted in a final publication. This includes the best, measurement of ν-nuclear scattering, in ν_{mu} ^{12}C inclusive cross sections. The measurement of the cross section for the exclusive reaction $\nu^{mu\,12}C \rightarrow \mu^{-12}$ N is unique. In a new development, Dr. Martoff has established a facility for fabrication of superconducting detectors of nuclear radiation; the equipment has been funded and is partly installed. Planned uses include scattering for 'Dark Matter.' In summary, the objectives for this year have been met.

7941 (DOE/ER/40423–27) **Physics challenges in the strong interactions.** Ellis, S.D. Washington Univ., Seattle, WA (United States). Dept. of Physics. Jan 1991. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AS06-88ER40423. (CONF-9006267–36: 1990 DPF summer study on high energy physics, Snowmass, CO (United States), 25 Jun - 13 jul 1990). Order Number DE92004395. Source: OSTI; NTIS; INIS; GPO Dep.

An overview of the challenges to be faced in the area of the strong interactions during the 1990's is presented. As an illustrative example special attention is given to the analysis of jets as studied at hadron colliders.

7942 (DOE/ER/40444–4-Add.) **Studies in medium energy physics: Progress report and continuation proposal, April 1, 1991–March 31, 1992: Addendum.** Green, A.; Hoffmann, G.W.; McDonough, J.; Purcell, M.J.; Ray, R.L.; Read, D.E.; Worn, S.D. Texas Univ., Austin, TX (United States). Dept. of Physics. Dec 1991. 94p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-88ER40444. Order Number DE92006451. Source: OSTI; NTIS; INIS; GPO Dep.

This document constitutes the (1991–1992) technical progress report and continuation proposal for the ongoing medium energy nuclear physics research program supported by the US Department of Energy through special Research Grant DE-FG05-88ER40444. The experiments discussed are conducted at the Los Alamos National Laboratory's (LANL) Clinton P. Anderson Meson Physics Facility (LAMPF) and the Alternating Gradient Synchrotron (AGS) facility of the Brookhaven National Laboratory (BNL). The overall motivation for the work discussed in this document is driven by three main objectives: (1) provide hadron-nucleon and hadron-nucleus scattering data which serve to facilitate the study of effective two-body interactions, test (and possibly determine) nuclear structure, and help study reaction mechanisms and dynamics; (2) provide unique, first-of-a-kind "exploratory" hadron-nucleus scattering data in the hope that such data will lead to discovery of new phenomena and new physics; and (3) perform precision tests of fundamental interactions, such as rare decay searches, whose observation would imply fundamental new physics.

7943 (DOE/ER/40614–2) **On defining the un-definable: JETS.** Ellis, S.D. Washington Univ., Seattle, WA (United States). Dept. of Physics. [1990]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-91ER40614. (CONF-9012124–1: Workshop on jet studies at LEP and HERA, Durham (United Kingdom), 8 Dec 1990). Order Number DE92004269. Source: OSTI; NTIS; INIS; GPO Dep.

A brief summary is presented of the current status of jet studies in hadron-hadron collisions. The primary focus is on those issues that would benefit from comparisons of jet samples obtained from hadron-hadron collisions, from e^+e^- annihilation events at LEP and from deep inelastic collisions at HERA. The important point is that, to perform this comparison properly, the jet various samples must be obtained using the same jet definition.

7944 (DOE/ER/40614–8) **Particle physics—Experimental: Annual progress report.** Lord, J.J.; Boynton, P.E.; Burnett, T.H.; Wilkes, R.J. Washington Univ., Seattle, WA (United States). Dept. of Physics. 21 Aug 1991. 52p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-91ER40614. Order Number DE92004253. Source: OSTI; NTIS; INIS; GPO Dep.

We are continuing a research program in particle astrophysics and high energy experimental particle physics. We have joined the DUMAND Collaboration, which is constructing a deep undersea astrophysical neutrino detector near Hawaii. Studies of high energy hadronic interactions using emulsion chamber techniques were also continued, using balloon flight exposures to ultra-high cosmic ray nuclei (JACEE) and accelerator beams. As members of the DUMAND Collaboration, we have responsibility for development a construction of critical components for the deep undersea neutrino detector facility. We have designed and developed the acoustical positioning system required to permit reconstruction of muon tracks with sufficient precision to meet the astrophysical goals of the experiment. In addition, we are making significant contributions to the design of the database and triggering system to be used. Work has been continuing in other aspects of the study of multiparticle production processes in nuclei. We are participants in a joint US/Japan program to study nuclear interactions at energies two orders of magnitude greater than those of existing accelerators, using balloon-borne emulsion chambers. On one of the flights we found two nuclear interactions of multiplicity over 1000 – one with a multiplicity of over 2000 and pseudorapidity density $\sim$ 800 in the central region. At the statistical level of the JACEE experiment, the frequency of occurrence of such events is orders of magnitude too large. We have continued our ongoing program to study hadronic interactions in emulsions exposed to high energy accelerator beams.

7945 (FNAL/C–91/287-E) **Direct production of high p_t leptons and search for additional heavy bosons at 1.8 TeV.** Gold, M. (Lawrence Berkeley Lab., CA (United States)). Fermi National Accelerator Lab., Batavia, IL (United States). Oct 1991. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-9107172–8: 15. joint international lepton photon symposium at high energies and European Physical Society (EPS) conference on high energy, Geneva (Switzerland), 25 Jul - 1 aug 1991). Order Number DE92004117. Source: OSTI; NTIS; INIS; GPO Dep.

We have studied the production of high p_t electrons and muons and searched for additional heavy charged (W′) and neutral (Z′) vector bosons. We find no evidence for such bosons and set limits of $M_w' > 520$ GeV and $M_Z' > 412$ GeV (95% confidence level) assuming Standard Model couplings. The production of high mass electron and muon pairs is consistent with the Standard Model prediction for the Drell-Yan production mechanism. Lower limits of 2.2 TeV and 1.6 TeV (95% confidence level) are set on electron-quark and muon-quark compositeness scale parameters Λ_{LL}^- associated with an effective contact interaction.

7946 (FNAL/C–91/328) **Recent heavy flavor physics results from fixed target experiments.** Spiegel, L. Fermi National Accelerator Lab., Batavia, IL (United States). Nov 1991. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-9106289–4: 3. topical seminar on heavy flavors, S. Miniato (Italy), Jun 1991). Order Number DE92005110. Source: OSTI; NTIS; INIS; GPO Dep.

Recent results from fixed target experiments in the field of heavy quark flavors, as published or otherwise disseminated in the last year, are reviewed. Emphasis is placed on distilling the main conclusions from these results. 35 refs., 5 figs., 4 tabs.

7947 (IC–91/102) **Odderon - A sharp signal at HERA.** Barahovsky, V.V. (Irkutsk Univ., Irkutsk (USSR). Physics Dept.); Shelkovenko, A.N.; Zhitnitsky, I.R. International Centre for Theoretical Physics, Trieste (Italy). May 1991. 9p. Order Number DE92609732. Source: OSTI; NTIS (US Sales Only); INIS.

The soon commissioning of the HERA provides for the first time an opportunity to study physics of odderon without any background in the process $ep \rightarrow e0^-p$. 10 refs, 3 figs.

7948 (IC–91/128) **Probing the flavour assymetric nucleon sea with week currents.** Kamran, M. International Centre for Theoretical Physics, Trieste (Italy). Jun 1991. 6p. Order Number DE92609742. Source: OSTI; NTIS (US Sales Only); INIS.

NMC has recently shown that the proton contains an excess of dd-bar sea pairs as compared to uu-bar sea pairs. We form appropriate combinations of quantities in v and v-bar DIS which are sensitive to this flavour asymmetry of the sea. Estimates of the sensitivity of these quantities to the flavour asymmetry of the sea are obtained. (author). 4 refs.

7949 (IC–91/133) **General analysis of weak decay form factors in heavy to heavy and heavy to light baryon transitions.** Hussain, F. (International Centre for Theoretical Physics, Trieste (Italy)); Liu Dongsheng; Kraemer, M.; Koerner, J.G.; Tawfiq, S. International Centre for Theoretical Physics, Trieste (Italy). Jun 1991. 22p. Order Number DE92609712. Source: OSTI; NTIS (US Sales Only); INIS.

We present a complete analysis of the heavy to heavy and heavy to light baryon semileptonic decays in the heavy quark effective theory within the framework of a Bethe-Salpeter (B-S) approach and demonstrate the equivalence of this approach to other work in the field. We present in a compact form the baryon B-S amplitudes which incorporate the symmetries manifest in the heavy quark limit and which also show clearly the light quark dynamics. A similar form of the B-S amplitude is presented for light baryons. Using the B-S amplitudes, the heavy to heavy and heavy to light semileptonic baryon decays are considered. As expected there is a dramatic reduction in the number of form factors. An advantage of our B-S approach is demonstrated where the form factors are written as loop integrals which in principle can be calculated. (author). 15 refs, 3 figs, 2 tabs.

7950 (INIS-mf–13026, pp. 237-238) **N-N scattering with COGEP.** Vijayakumar, K.B. (Physical Research Lab., Ahmedabad (India)); Khadkikar, S.B. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. 6 refs. GLUONS/nucleon-nucleon interactions; GLUEBALLS; GLUONS; NUCLEON-NUCLEON POTENTIAL; PHASE SHIFT; QUARKS; RELATIVISTIC RANGE; SCATTERING; STRONG INTERACTIONS

7951 (INIS-mf–13026, pp. 245-246) **Distortion effects in (p, Δ^{++}) reaction.** Kelkar, N.G. (Bhabha Atomic Research Centre, Bombay (India). Nuclear Physics Div.); Jain, B.K. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. PROTON REACTIONS/distorted wave theory; PROTON REACTIONS/mass distribution; DELTA BARYONS; GEV RANGE 01-10; ISOSPIN; MEV RANGE 100-1000; MISSING-MASS SPECTRA; S MATRIX; SPIN

7952 (INIS-mf–13026, pp. 249-250) **Study of secondary particles produced in high energy hadronic interactions.** Khushnood, H. (Jamia Milia Islamia, New Delhi (India). Dept. of Physics); Ansari, A.R. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. PION MINUS REACTIONS/multiple production; PROTON REACTIONS/multiple production; ENERGY DEPENDENCE; GEV RANGE 01-10; GEV RANGE 10-100; GEV RANGE 100-1000; HADRON-HADRON INTERACTIONS; MULTIPLICITY; SHOWERS; THEORETICAL DATA

7953 (INIS-mf–13026, pp. 251-252) **N-N interaction in confinement model for QCD.** Vijayakumar, K.B. (Physical Research Lab., Ahmedabad (India)). Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. 5 refs. NUCLEON-NUCLEON INTERACTIONS/quantum chromodynamics; BAG MODEL; GLUEBALLS; GLUONS; KERNELS; PHASE SHIFT; QUARKS; RELATIVISTIC RANGE; SCATTERING

7954 (INIS-mf–13026, pp. 253-254) **Cheshire cat syndrome in N-N scattering.** Khadkikar, S.B. (Physical Research Lab., Ahmedabad (India)); Vijayakumar, K.B. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. 5 refs., 2 figs. NUCLEON-NUCLEON INTERACTIONS/gluons; NUCLEON-NUCLEON INTERACTIONS/scattering; HAMILTONIANS; MESONS; MEV RANGE 01-10; MEV RANGE 10-100; MEV RANGE 100-1000; GLUONS; SCATTERING; PHASE SHIFT; QUARKS; RELATIVISTIC RANGE; S WAVES; VARIATIONAL METHODS

7955 (INIS-mf–13026, pp. 263-264) **Pion cloud contribution to hadron masses in variable bag pressure model.** Singh, C.P. (V.S.S.D. Coll., Kanpur (India). Dept. of Physics); Singh, S.; Singh, R.L. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. 1 tab. HADRONS/mass; BAG MODEL; HADRONS; MASS; PIONS; QUARKS; THEORETICAL DATA

7956 (INIS-mf–13026, pp. 265-266) **Role of rho in charge exchange reactions.** Santra, A.B. (Bhabha Atomic Research Centre, Bombay (India). Nuclear Physics Div.); Jain, B.K. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. PROTON-NEUTRON INTERACTIONS/rho-770 mesons; PROTON-PROTON INTERACTIONS/rho-770 mesons; DELTA BARYONS; DWBA; FOUR MOMENTUM TRANSFER; GEV RANGE 01-10; MEV RANGE 100-1000; NEUTRONS; NUCLEON-NUCLEON INTERACTIONS; PIONS; PROTONS; SCATTERING AMPLITUDES; TOTAL CROSS SECTIONS

7957 (INIS-mf–13026, pp. 269-270) **A stochastic model for multiparticle production.** Chaudhuri, A.K. (Variable Energy Cyclotron Centre, Calcutta (India)). Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. HADRON-HADRON INTERACTIONS/multiple production; MULTIPLE PRODUCTION/stochastic processes; ANALYTICAL SOLUTION; CHARGED PARTICLES; ENERGY DEPENDENCE; EXCITATION; PARTICLE MODELS

7958 (INIS-mf–13073) **Production and decay of charged intermediate vector bosons in p anti p collisions.** Guchte, M.W. van de. Rijksuniversiteit Utrecht (Netherlands). 4 Sep 1991 169p. Order Number DE92614205. Source: OSTI; NTIS (US Sales Only); INIS.

Includes summary in Dutch.

This thesis describes an experiment performed with the UA1 detector at the Spp-barS at CERN on the production and decay of $W^{\pm}$ bosons in proton-antiproton collisions. In particular the total width of the $W^{\pm}$ resonance has been determined. A direct measurement of this quantity already exists, but with an uncertainty of 70%. Here an indirect method is presented in which this quantity is inferred from the ratio of the $W \rightarrow l\nu$ and $Z \rightarrow$ ll-bar partial cross sections measured at pp-bar colliders and the total width of the Z boson, accurately measured at LEP. It exploits the complementary results of pp-bar and e^+e^- machines and allows to bring down the uncertainty on the total width to about 8%. The results is compared with the Standard Model prediction and its implication for the mass of the top quark is investigated. Also the possibility to put a constraint on the masses of the new elementary particles predicted by the Super Symmetry model is considered. (author). 126 refs.; 67 figs.; 23 tabs.

7959 (LA-UR–91-3962) **Nuclear effects on heavy quark production: Results from Fermilab Experiments E772 and E789.** E772 and E789 Collaborations. Los Alamos National Lab., NM (United States). [1991]. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-9111165–1: Quark matter '91, Gatlinburg, TN (United States), 11-15 Nov 1991). Order Number DE92005067. Source: OSTI; NTIS; INIS; GPO Dep.

Fermilab Experiments E772 and E789 are fixed target experiments with 800 GeV protons incident on nuclear targets corresponding to a center-of-mass energy of $\sqrt{s} \sim 39$ GeV. Measurements are made with a pair spectrometer which has a solid angle of a few percent and operates at high luminosity with up to $\sim 10^{12}$(E772) or $\sim 10^{11}$(E789) protons/spill. Our experimental program explores several types of nuclear medium effects: the modification of quark and gluon structure functions by the nucleus, effects on the production of vector mesons (e.g. J/ψ and γ), and effects on the production of D mesons. The latter is accomplished with the use of a new silicon vertex detector. E789 also looks at the decays of B mesons including the decay to J/ψ and searches for the decays to two-charged particles (e.g. $B \rightarrow h^+h^-$) but I will not discuss this part of our program in this paper.

7960 (LYCEN–91-06) **Neutrino scattering and pion physics.** Ericson, M. (Lyon-1 Univ., 69 - Villeurbanne (FR). Inst. de Physique Nucleaire). Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. 1991. 12p. (CONF-9007206–: 7. International School of Intermediate Energy Nuclear Physics, L'Aquila (Italy), 16-26 Jul 1990). Order Number DE92743610. Source: OSTI; NTIS (US Sales Only).

In the forward direction neutrino scattering is linked to pion physics. We discuss the occurrence of a shadow effect in the forward neutrino cross-section on nuclei, owing to the collective nature of the pionic nuclear response.

7961 (NIKHEF-H–91-15) **Searching for supersymmetry at LEP/LHC.** Janssen, M.M.J.F. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H). Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H. Jul 1991. 23p. Order Number DE92614204. Source: OSTI; NTIS (US Sales Only); INIS.

For the ep collider at LEP/LHC, the production and the signal coming from s-leptons and s-quarks are studied for several processes. It is shown how the supersymmetry signal can be extracted from the Standard Model background processes. In particular the large backgrounds due to single W and Z production are considered. All the results are based on exact calculations of the matrix elements at tree level. Total cross sections and various kinematical distributions are presented. (author). 20 refs.; 7 figs.; 3 tabs.

7962 (SLAC-PUB–5669) **An amplitude analysis of the $K\bar{K}$ and $\pi^+\pi^-$ systems ($M < 2$ GeV/c^2) produced in J/ψ radiative decay.** Chen, Liang-Ping (Vanderbilt Univ., Nashville, TN (United States)). MARK III Collaboration. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Oct 1991. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515 ;AC02-76ER01195 ;AC02-87ER40318 ;AC03-81ER40050 ;AM03-76SF00010. (CONF-910864–7: 4. international conference on hadron spectroscopy, College Park, MD (United States), 12-16 Aug 1991). Order Number DE92004775. Source: OSTI; NTIS; INIS; GPO Dep.

A mass independent amplitude of the $K\bar{K}$ and $\pi^+\pi_-$ systems ($M < 2$ GeV/c^2) produced in J/ψ radiative decay is presented. For the first time a large spin zero component in the θ(1720) mass region is observed, with all data samples analyzed. A small amount of spin two component in this mass region for the $K\bar{K}$ data samples is not ruled out with the present statistics. This study reveals, also for the first time, the production of the $f_o(1400)$ in the $\pi^+\pi^-$ channel, and refines previous measurements of the $f_2(1270)$ and $f'_2(1525)$. 13 refs., 2 figs., 2 tabs.

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Refer also to citation(s) 7254, 7412, 7842, 7912, 7913, 7915, 7922, 7923, 7933, 7940, 7945, 7946, 7997

7963 (ANL-HEP-CP–91-88) **η_6 Production.** Kang, Kyungsik (Brown Univ., Providence, RI (United States). Dept. of Physics); White, A.R. Argonne National Lab., IL (United States). Oct 1991. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-9107172–5: 15. joint international lepton photon symposium at high energies and European Physical Society (EPS) conference on high energy, Geneva (Switzerland), 25 Jul - 1 aug 1991; BROWN-HET–838). Order Number DE92004161. Source: OSTI; NTIS; INIS; GPO Dep.

We suggest that a short-lived axion-like particle η_6 with mass around 30 GeV should be produced diffractively at hadron colliders. This is the lightest particle belonging to a new color- sextet quark sector of QCD which could be responsible for dynamical symmetry breaking of the electroweak interaction.

7964 (BNL–46863) **Double-Pomeron and two-photon processes at RHIC.** Chung, S.U.; Weygand, D.P.; Willutzki, H.J. Brookhaven National Lab., Upton, NY (United States). Nov 1991. 30p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE92005039. Source: OSTI; NTIS; INIS; GPO Dep.

Double-Pomeron processes have been shown to be an important and novel source of hadron production at moderate energies at the ISR. These processes are expected to provide glue-rich hadrons from 1 GeV to 10 GeV or more, encompassing the states consisting of u, d, s and b quarks. The double-pomeron cross sections for central hadroproduction are calculated for p × p and Au × Au at RHIC. Two-photon production of hadrons in the central region begins to dominate or at least become comparable to the double-Pomeron processes as the Z of the beams increases from p to Au. Since photons couple to charge, these hadroproductions involve mainly quarkonia and multiquark states. Therefore, a comparative study of these processes is expected to provide new insights into the constituents of hadronic matter. The two-photon processes are calculated following the recipe given by Cahn and Jackson. The paper starts out with a thorough discussion of the relevant kinematics, phase space and Regge amplitudes.

7965 (DESY–91-093) **The package PAKPDF ver. 1.1 of parametrizations of parton distribution functions in the proton.** Charchula, K. Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany). Aug 1991. 18p. Order Number DE92758962. Source: OSTI; NTIS (US Sales Only); INIS.

Any computer with FORTRAN 77 compiler (IBM, VAX ...); FORTRAN 77.

A FORTRAN package containing parametrizations of parton distribution functions (PDFS) in the proton is described. It allows an easy access to PDFS provided by several recent parametrizations and to some parameters characterizing particular parametrization. Some comments about the use of various parametrizations are also included. (orig.).

7966 (DOE/ER/40107–10A) **[Experimental investigation of the production of glueballs and meson resonant states]: Technical progress report for the period ending January 15, 1992.** Lindenbaum, S.J. City Coll., New York, NY (United States). 13 Nov 1991. 22p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-83ER40107. Order Number DE92004055. Source: OSTI; NTIS; INIS; GPO Dep.

We have made striking and considerable progress in our AGS program which is searching for a Quark-Gluon Plasma or other new phenomena at the AGS. We are employing a TPC Tracking Magnetic Spectrometer that has handled up to ≈ 100 tracks, the maximum observed in 14.5 GeV/c × A Si ions incident on Au and Cu. In essence the TPC covers more than the forward half hemisphere in the nucleon-nucleon cms (i.e. $\geq 2\pi$) and thus allow tracking, momentum and angular analysis of the charged particles emitted in these heavy ion collisions. Particle identification for negative pions can be made approximately by assuming negative particles are pions. Then by subtraction of negatives from positives in a suitable manner the proton characteristics can be determined. Λ and K_s° V particles have been identified singly in events and $\approx$ 50 double Λ and 2 triple Λ events have been observed in the relatively small data sample ($\sim$ central like events) we have obtained and analyzed this year.

7967 (DOE/ER/40150–178) **Few-body experimental program at CEBAF.** Mougey, J. Southeastern Universities Research

Association, Newport News, VA (United States). Continuous Electron Beam Accelerator Facility. [1991]. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84ER40150. (CEBAF-PR-91-046;CONF-9109122-6: 13. European conference on few-body problems in physics, Elba (Italy), 9-14 Sep 1991). Order Number DE92005090. Source: OSTI; NTIS; INIS; GPO Dep.

Nearly two thirds of the initial CDBAF physics proposals deal with experimental studies of the nucleon and few nucleon $(A \leq 4)$ systems. These studies include the structure of nucleons at high Q^2, the electro- and photodisintegration of the deuteron, and the short distance structure of ^{3}He and ^{4}He. Emphasis is given to coincidence experiments and measurements of polarization observables. 59 refs., 8 figs., 1 tab.

7968 (DOE/ER/40243-8) **Medium energy elementary particle physics: Technical progress report, August 1, 1990–June 30, 1991.** Yale Univ., New Haven, CT (United States). [1991]. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER40243. Order Number DE92004413. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the following topics: muon beam development at LAMPF; muon physics; a new precision measurement of the muon g-2 value; measurement of the spin-dependent structure functions of the neutron and proton; and meson factories. (LSP)

7969 (DOE/ER/40427-24-N91) **Some measurements for determining strangeness matrix elements in the nucleon.** Henley, E.M. (Washington Univ., Seattle, WA (United States)); Pollock, S.J.; Ying, S.; Frederico, T.; Krein,; Williams, A.G. Washington Univ., Seattle, WA (United States). [1991]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-88ER40427. (CONF-9109122-5: 13. European conference on few-body problems in physics, Elba (Italy), 9-14 Sep 1991). Order Number DE92004272. Source: OSTI; NTIS; INIS; GPO Dep.

Some experiments to measure strangeness matrix elements of the proton are proposed. Two of these suggestions are described in some detail, namely electro-production of phi mesons and the difference between neutrino and antineutrino scattering for isospin zero targets such as deuterium.

7970 (DOE/ER/40561-20) **Strong CP violation and the neutron electric dipole moment revisited.** Aoki, Sinya (State Univ. of New York, Stony Brook, NY (United States). Inst. for Theoretical Physics); Hatsuda, Tetsuo. Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory. Jul 1991. 26p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract FG06-90ER40561. Grant NSF-PHY-89-08495. Order Number DE92004373. Source: OSTI; NTIS; INIS; GPO Dep.

The relation between the CP violating operator $\theta F\tilde{F}$ and its effective version $L_{CP}{}^{eff}$ is reconsidered on the basis of the anomalous Ward-Takahashi (WT) identity. The consistency of the previous phenomenological calculations of the neutron electric dipole moment (NEDM) with the WT identity is critically examined. A consistent evaluation of an $O(N_c{}^{o})$ contribution to NEDM is given and the result is compared with the leading term in the chiral expansion which is $O(N_c{}^{-1})$.

7971 (DOE/ER/40561-21) **Measuring strangeness matrix elements of the nucleon.** Henley, E.M. (Washington Univ., Seattle, WA (United States)); Pollock, S.J.; Krein, G.; Williams, A.G. Washington Univ., Seattle, WA (United States). [1991]. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-90ER40561. Order Number DE92004374. Source: OSTI; NTIS; INIS; GPO Dep.

Experiments are proposed to measure various strangeness matrix elements of the nucleon. Examples are electro- and neutrinoproduction of phi mesons and the difference between neutrino and antineutrino scattering from isospin zero targets, e.g., deuterons.

7972 (DOE/ER/40561-24) **Good component approach in light-cone quantum mechanics of the deuteron form-factors.** Strikman, M.I.; Frankfurt, L.L.; Frederico, T. Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory. 17 Aug 1991. 26p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-90ER40561 ;FG06-88ER40427. (DOE/ER/40427-21-N91). Order Number DE92004377. Source: OSTI; NTIS; INIS; GPO Dep.

We discuss the criteria for the choice of matrix elements of the "good" component of the current in the calculation of deuteron form-factors in Light-Cone Quantum Mechanics. We use the infinite-momentum frame matrix elements of the currents and boost them to the Briet-frame which is utilized often in the numerical calculations. We show in a straight-forward procedure how to deal with such transformations. It can be easily generalized to other cases. The electromagnetic functions $A(q^2)$ and $B(q^2)$ and axial form-factor are obtained and compared with previous calculations. We study the tensor polarization of the deuteron.

7973 (DOE/ER/40561-29) **Flavor symmetry in the large N_c limit.** Karl, G. (Guelph Univ., ON (Canada). Dept. of Physics); Lipkin, H.J. Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory. [1991]. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-90ER40561. Order Number DE92004384. Source: OSTI; NTIS; INIS; GPO Dep.

An essential difference between two-flavor and three-flavor descriptions of baryons in large N_c QCD is discussed in detail. For $N_c \geq 3$ a state with the SU(3) flavor quantum numbers of the proton must contain a number of strange quarks $n_s \geq (N_c-3)/3$, while a state with no strange quarks must have extra hypercharge $Y-1 = 3/N_c-1$. The extra strangeness or extra hypercharge which vanishes for $N_c = 3$ is spurious for the physical proton. This problem does not arise in two-flavor QCD, where the flavor-SU(2) Skyrmion may give a good approximation for nucleon-pion physics at low energies below strangeness threshold. But any nucleon model with SU(3) flavor symmetry which is interpreted as arising from the large N_c limit in QCD can lead to erroneous conclusions about the spin and flavor structure of the proton. 12 refs.

7974 (DOE/ER/40561-30) **Old and new physics in nucleon spin structure.** Lipkin, H.J. (Weizmann Inst. of Science, Rehovoth (Israel). Dept of Physics). Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory. [1991]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-90ER40561. Order Number DE92004385. Source: OSTI; NTIS; INIS; GPO Dep.

EMC implies quarks carry very little of the proton spin. $(G_A/G_V)_{n\to p}$ implies that valence quarks carry 70% of the spin, but disagrees with SU(6). $(G_A/G_V)_{\Sigma^-\to n}$ agrees strinkingly with SU(6). All semileptonic decay data can be fit by SU(3), but no model fits the data by breaking SU(6) without also breaking SU(3). Considerable data on hadron masses and magnetic moments are fit by a simple constituent quark model with only constituent quarks. A toy model for the proton with valence quarks and sea fits nearly everything.

7975 (DOE/ER/45445-3) **Research using ultracold neutrons at the ILL.** Steyerl, A. Rhode Island Univ., Kingston, RI (United States). [1990]. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-91ER45445. (CONF-9010278-2: 6. international school on neutron physics, Alushta (USSR), 8-18 Oct 1990). Order Number DE92004842. Source: OSTI; NTIS; INIS; GPO Dep.

In this talk I will make no effort to give an exhaustive, detailed description of the well-published results of recent work with ultracold neutrons (UCN) at the ILL. Instead, there will be a biased selection of some topics in which author happens to be most interested, though in some cases as a spectator from a considerable distance than as an actor. The selection includes the recent lifetime experiment using a Fomblin-coated bottle, the continuing search for an electric dipole moment of the neutron and some ideas on high precision neutron optics experiments.

7976 (FNAL/C-91/294-E) **Top search at CDF.** Contreras, M. (Chicago Univ., IL (United States)). The CDF Collaboration. Fermi National Accelerator Lab., Batavia, IL (United States). Oct 1991. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-9107172-9: 15. joint international lepton photon symposium at high energies and European Physical Society (EPS) conference on high energy, Geneva (Switzerland), 25 Jul - 1 aug 1991). Order Number DE92004803. Source: OSTI; NTIS; INIS; GPO Dep.

We review top quark searches carried out at CDF with data collected during the 1988–1989 Collider Run. The latest analyses give a lower limit on the top quark mass of 91 GeV/c^2 at the 95% confidence level, assuming Standard Model decays. 8 refs., 6 figs., 1 tab.

7977 (IC–91/134) **The B_c and B-bar$_c$ mesons accessible to experiments through Z^0 boson decay.** Chang Chaohsi (International Centre for Theoretical Physics, Trieste (Italy)); Chen Yuqi. International Centre for Theoretical Physics, Trieste (Italy). Jun 1991. 15p. (AS-ITP–91-19;CCAST–91-21.). Order Number DE92609743. Source: OSTI; NTIS (US Sales Only); INIS.

The B_c and B-bar$_c$ meson production with jets through Z^0 decay is computed based on the Standard Model. The result shows that about one thousand and four hundred events involving one B_c or B-bar$_c$ meson will be obtained, if 10^7 Z^0 intermediate bosons are accumulated such as planned for LEP-I. The cross section of $e^+e^- \rightarrow B_c$ + jets (or B-bar$_c$ + jets) for the energy from 15 GeV to 60 GeV is also presented. (author). 11 refs, 3 figs, 2 tabs.

7978 (IC–91/140) **Properties of B_c-meson in QCD sum rules.** Aliev, T.M. (Istanbul Univ., Istanbul (Turkey). Physics Dept.); Yilmaz, O. International Centre for Theoretical Physics, Trieste (Italy). Jun 1991. 13p. Order Number DE92609744. Source: OSTI; NTIS (US Sales Only); INIS.

We have studied the masses of the scalar, pseudoscalar and vector states of B_c-meson and their constants in the framework of the QCD sum rules. (author). 10 refs, 6 figs.

7979 (IC–91/161) **On gauge invariance of the renormalized Z^0 rest mass.** Ward, B.F.L. International Centre for Theoretical Physics, Trieste (Italy). Jul 1991. 6p. Contract DE-AS05-76ER03956;Contract DE-AC05-76SF00515;Grant RCFY Order Number DE92615300. Source: OSTI; NTIS (US Sales Only); INIS.

The properly renormalized Z^0 rest mass is shown to be gauge invariant in the rigorous, complete on-shell renormalization scheme. Thus, the mass measured at LEP/SLC is indeed a physical observable and can be used as a basic parameter of the $SU_{2L}xU_1$ theory, as indeed it has so been. (author). 8 refs.

7980 (IC–91/291) **Heavy baryon transitions and the heavy quark effective theory.** Hussain, F. International Centre for Theoretical Physics, Trieste (Italy). Sep 1991. 11p. Order Number DE92615301. Source: OSTI; NTIS (US Sales Only); INIS.

Heavy baryon decays are studied in the context of the Bethe-Salpeter approach to the heavy quark effective theory. A drastic reduction, in the number of independent form factors, is found. Results are presented both for heavy to heavy and heavy to light baryon decays. (author). 17 refs, 3 figs, 2 tabs.

7981 (INIS-mf–13026, pp. 255-256) **Baryon spectroscopy in chiral color dielectric model.** Phatak, S.C. (Institute of Physics, Bhubaneswar (India)); Sahu, S. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ANTIOMEGA PARTICLES/mass; LAMBDA PARTICLES/mass; NUCLEONS/mass; QUARKS/mass; SIGMA NEUTRAL PARTICLES/mass; XI PARTICLES/mass; MASS; BAG MODEL; BARYON DECUPLETS; BARYON OCTETS; BARYON SPECTROSCOPY; COLOR MODEL; GEV RANGE 01-10; NUCLEONS; QUARKS

7982 (INIS-mf–13026, pp. 257-258) **Mass spectra of baryons.** Singh, Harikesh (Institute of Basic Sciences, Khandari (India). Dept. of Physics); Gautam, A.K. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. BARYONS/mass spectra; BAG MODEL; BARYONS; GEV RANGE 01-10; PARTICLE RADII; QUARKS

7983 (INIS-mf–13026, pp. 261-262) **Instanton contribution to electromagnetic mass differences of baryons.** Singh, C.P. (V.S.S.D. Coll., Kanpur (India). Dept. of Physics); Singh, S.; Singh, R.L. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. 1 tab. BARYONS/mass difference; BAG MODEL; BARYONS; INSTANTONS; QUANTUM CHROMODYNAMICS; QUARKS; THEORETICAL DATA; WAVE FUNCTIONS

7984 (INIS-mf–13026, pp. 281-282) **Equations of state and entropy per baryon in a QCD phase transition.** Sakthi Murugesan, K. (Madras Univ. (India). Dept. of Nuclear Physics); Subramanian, P.R. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. BARYONS/equations of state; BARYONS/phase transformations; QUARK MATTER/phase transformations; BARYONS; ENTROPY; MEV RANGE 10-100; MEV RANGE 100-1000; QUANTUM CHROMODYNAMICS; QUARK-GLUON INTERACTIONS

7985 (INIS-mf–13026, pp. 233-234) **Quark-antiquark bound states.** Gautam, A.K. (R.B.S Col., Agra (India). Dept. of Physics); Shiromani, A.K. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. QUARKS/bound state; QUARKS/mass spectra; TOPONIUM/mass spectra; COULOMB FIELD; HADRONIC PARTICLE DECAY; HARMONIC POTENTIAL; LEPTONIC DECAY; QUARKS; TOPONIUM

7986 (INIS-mf–13026, pp. 239-240) **Fermi-Breit interaction among confined quarks and gluons.** Vinodkumar, P.C. (Physical Research Lab., Ahmedabad (India)); Vijayakumar, K.B.; Khadkikar, S.B. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. GLUONS/fermi interactions; QUARKS/fermi interactions; FOURIER TRANSFORMATION; GLUONS; HADRONS; HARMONIC OSCILLATORS; NUCLEON-NUCLEON INTERACTIONS; QUARKS; RELATIVISTIC RANGE; SCATTERING AMPLITUDES; WAVE FUNCTIONS

7987 (INIS-mf–13026, pp. 241-242) **E2/M1 ratio for $\Delta \rightarrow N + \gamma$ in a chiral quark model.** Ghosh, B. (Institute of Physics, Bhubaneswar (India)); Phatak, S.C. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. QUARK MODEL/m1-transitions; QUARK MODEL/transition amplitudes; BAG MODEL; CHIRALITY; DELTA BARYONS; E2-TRANSITIONS; GAMMA RADIATION; MATRIX ELEMENTS; NUCLEONS; PHOTON EMISSION; M1-TRANSITIONS; QUARKS; WAVE FUNCTIONS

7988 (INIS-mf–13026, pp. 243-244) **A lower limit of g_1^P from NRQM.** Nag, R. (Banaras Hindu Univ., Varanasi (India). Dept. of Physics); Sanyal, S.; Mukherjee, S.N. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. PROTONS/structure functions; ASYMMETRY; PROTONS; QUARK MODEL; SPIN; WAVE FUNCTIONS

7989 (INIS-mf--13026, pp. 275-276) **Phase transition from a QGP to hadrons in the early universe.** Sakthi Murugesan, K. (Madras Univ. (India). Dept. of Nuclear Physics); Subramanian, P.R. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123--: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. 6 refs. QUARK MATTER/phase transformations; UNIVERSE/quark matter; COSMOLOGICAL MODELS; CRITICAL PRESSURE; ENERGY DENSITY; GLUONS; HADRONS; QUARK-GLUON INTERACTIONS; QUARKS; RELATIVISTIC RANGE; UNIVERSE

7990 (INIS-mf--13026, pp. 277-278) **Quark matter in colour-dielectric model.** Ghosh, S.K. (Institute of Physics, Bhubaneswar (India)); Phatak, S.C. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123--: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. QUARK MATTER/color model; BARYONS; COUPLING CONSTANTS; GLUONS; INSTABILITY; LAGRANGIAN FUNCTION; PIONS; QUARKS; THERMODYNAMIC PROPERTIES

7991 (INIS-mf--13026, pp. 283) **Relativistic QCD-motivated potential model of heavy-light quarks confined nucleons.** Swarup, R. (D.S. Coll., Aligarh (India). Dept. of Physics); Singh, R.N. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123--: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. QUARKS/quantum chromodynamics; DISTURBANCES; MASS; NUCLEONS; QUARKS; RELATIVISTIC RANGE

7992 (JINR-E--2-90-24) **Quark-diquark approximation of the three-quark structure of baryons in the quark confinement model.** Efimov, G.V.; Ivanov, M.A.; Lyubovitskij, V.E. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics. 1990. 34p. Order Number DE92609746. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Z. Phys., C.

Octet $(1^+/2)$ and decuplet $(3^+/2)$ of baryons as relativistic three-quark states are investigated in the quark confinement model (QCM), the relativistic quark model, based on some assumptions about hadronization and quark confinement. The quark-diquark approximation of the three-quark structure of baryons is proposed. In the framework of this approach the description of the main low-energy characteristics of baryons as magnetic moments, electromagnetic radii and form factors, ratio of axial and vector constants in semileptonic baryon octet decays, strong form factors and decay widths is given. The obtained results are in agreement with experimental data. 31 refs.; 4 figs.; 5 tabs.

7993 (Juel--2469) **Workshop on mesons and mesonic states up to slightly above 1 GeV/c^2.** Oelert, W.; Sefzick, T. (eds.). Forschungszentrum Juelich GmbH (Germany). Inst. fuer Kernphysik. Apr 1991. 213p. (CONF-9002204--: Workshop on mesons and mesonic states up to slightly above 1 GeV/c^2, Juelich (Germany), 19-20 Feb 1990). Order Number DE92758891. Source: OSTI; NTIS (US Sales Only); INIS.

The new accelerator COSY-Juelich will provide protons with momenta up to 3.3 GeV/c. Thus an effective mass slightly above 1 GeV/c^2 can be produced in the pp-interaction. Employing higher mass targets also heavier mesons can be observed. The production of single mesons and of mesonic states with and without strangeness can be investgated at COSY. The structure of some mesons in the mass range of 950 MeV/c^2 to 1020 MeV/c^2 is still not well understood. While the $\Phi(1020)$ at the upper limit of this range is believed to be of rahter pure santi s nature the content of the $\eta'(958)$ meson at the lower limit of this range is still under discussion. New results suggest that what is called the f_0 meson (former notation S^*) consists in reality of two close and narrow states; one of them being a santi s - quarks configuration while the other should be a flavour singlet which couples to $\pi\pi$ and Kanti K with similar strengths. Also the discussion on possible gluonium candidates is still alive. It is speculated that some of these mesons - till now supposed to have widths of 30 to 50 MeV/c^2 - could rather be an overlay of structures with much smaller widths. Another features of resonances in this region is their partial decay into the Kanti K channel if their actual mass is large enough. Strong decays in Kanti K could be a signal of a Kanti K 'molecular' nature of the resonance. In particular the atomic K^+K^- structure should exist. In order to have review of the physics related to these problems there was a workshop held on: MESONS and MESONIC STATES up to slightly above 1 GeV/c^2 at the ZEL - Forschungszentrum - Juelich February 19 to 20, 1990. The following contains copies of the shown transparencies and short write-ups as far as available. (orig.).

7994 (SLAC-PUB--5682) **The strange 0^{++} and 2^{++} radial excitations: A review of LASS data.** Aston, D. (Stanford Linear Accelerator Center, Menlo Park, CA (United States)); Bienz, T.; Bird, F.; Dunwoodie, W.; Johnson, W.B.; Kunz, P.; Kwon, Y.; Leith, D.W.G.S.; Levinson, L.; Ratcliff, B.N.; Rensing, P.; Schultz, D.; Shapiro, S.; Sinervo, P.K.; TarnStanford Linear Accelerator Center, Menlo Park, CA (United States). Oct 1991. 4p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract AC03-76SF00515. Grant PHY82-09144;Grant PHY85-13808. (CONF-910864--8: 4. international conference on hadron spectroscopy, College Park, MD (United States), 12-16 Aug 1991). Order Number DE92004713. Source: OSTI; NTIS; INIS; GPO Dep.

The experimental status of the strange 0^{++} and 2^{++} mesons is briefly reviewed and compared with expectations from the quark model. The results are taken from a high statistics study of strange mesons produced in LASS by an 11 GeV/c K^- beam. 13 refs., 8 figs., 1 tab.

7995 (SLAC-PUB--5710) **Long baseline neutrino experiments with the Fermilab Main Injector.** Bjorken, J.D. Stanford Linear Accelerator Center, Menlo Park, CA (United States). Dec 1991. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-9111141--1: Workshop on long-baseline neutrino oscillations, Batavia, IL (United States), 17-20 Nov 1991). Order Number DE92004745. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains a talk on experiments to detect neutrino oscillations. (LSP)

7996 (WUB--90-13) **Structure function measurements in the deep inelastic muon-nucleon scattering.** Peschel, H. Wuppertal Univ. (Gesamthochschule) (Germany). Fachbereich 8 - Naturwissenschaften 1 - Physik. Mar 1991. 151p. (In German). Order Number DE92758921. Source: OSTI; NTIS (US Sales Only); INIS.

Measurements of deep inelastic scattering events on a combined copper and deuterium target were performed by the European Muon Collaboration (EMC) using a muon beam at CERN's SPS with energies at 100 GeV and 280 GeV. The data are analysed and compared with a detailed Monte-Carlo simulation and allow the determination of structure functions from both targets. In the light of the present discrepancy between EMC's and BCDMS's structure functions, stringend cuts were applied to the data. The results confirm the EMC structure function measurements on unbound nucleons. The comparison between the copper structure function from this experiment and the NA2 iron structure function shows a trend to lower values at low x_{Bj}. (orig.).

6630 Nuclear Physics

Refer also to citation(s) 7133

6631 Nuclear Structure

Refer also to citation(s) 7967, 8058, 8059, 8062

7997 (ANL/CP--74387) **Microscopic calculations of Λ single particle energies.** Usmani, Q.N. (Jamia Milia Islamia, New Delhi (India)); Sami, M.; Bodmer, A.R. Argonne National Lab., IL

(United States). [1991]. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-911208–1: International symposium on hypernuclear and strange particle physics, Shimoda (Japan), 9-12 Dec 1991). Order Number DE92004152. Source: OSTI; NTIS; INIS; GPO Dep.

Short communication. LAMBDA PARTICLES/binding energy; PION REACTIONS; HYPERNUCLEI; SCATTERING; NUCLEAR MATTER

7998 (BNL–46635) **Shapes and excitations of heavy nuclei: Exploiting the simplicities of algebraic models.** Casten, R.F. (Brookhaven National Lab., Upton, NY (United States)). Brookhaven National Lab., Upton, NY (United States). [1991]. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-9109250–4: International symposium group theory and special symmetries in nuclear physics, Ann Arbor, MI (United States), 19-21 Sep 1991). Order Number DE92005011. Source: OSTI; NTIS; INIS; GPO Dep.

Despite years of study there are still major unanswered questions concerning the shapes of medium and heavy nuclei and the nature of their intrinsic excitations. Some of these questions may profitably be addressed by exploiting the simplicities inherent in algebraic models. Examples, using the IBA, focusing on axial asymmetry, the nature of β and γ vibrations, and octupole correlations will be briefly discussed.

7999 (CONF-8908129–6) **Evolution of nuclear collectivity at high spins and temperatures.** Baktash, C. Oak Ridge National Lab., TN (United States). [1989]. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 12. workshop on nuclear physics; Iguazu Falls (Argentina); 28 Aug - 1 sep 1989. Order Number DE92004220. Source: OSTI; NTIS; INIS; GPO Dep.

In the past few years, we have utilized the Spin Spectrometer and a variety of complementary probes (continuum γrays, proton-γ coincidence spectroscopy and γ decay of GDR) to study the nuclear response to the DIFFERENTIAL effects of increasing spin and temperature for constant values of excitation energy or spin, respectively. In this paper we shall describe two of the experiments that trace the properties of rapidly-rotating nuclei at small to moderate excitation energies. 22 refs., 7 figs.

8000 (CONF-9103176–4) **Finite-temperature effects in warm nuclei: Recent developments and open questions.** Baktash, C. Oak Ridge National Lab., TN (United States). [1991]. 22p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Workshop on future directions in nuclear physics with 4π gamma detection systems of the new generation; Strasbourg (France); 4-16 Mar 1991. Order Number DE92004221. Source: OSTI; NTIS; INIS; GPO Dep.

Study of the finite-temperature effects in nuclear systems remain one of the least explored subjects in low-energy nuclear physics, despite the fact that dramatic structural changes are expected to unfold as the excitation energy of the system is increased. Gradual vanishing of the pairing correlations, onset of chaos and rotational damping, prolate-to-oblate shape changes, melting of the shell effects, and eventually the inability of the compound nucleus (CN) to sustain giant resonances at very high temperatures ("death" of CN) are only a few examples of the rich and varied phenomena yet to be explored. Equally important is the question of thermal fluctuations and the extent to which they modify the above phase transitions. However, a prerequisite to the study of these fascinating questions is a detailed understanding of the formation and decay modes of compound nucleus which is astonishingly, lacking at present. In this chapter we shall discuss some recent experimental and theoretical developments that (a) raise new questions about these pivotal issues, and (b) provide clues and directions toward their resolution. They include questions of equilibration of CN (entrance-channel effects in fusion reactions, and structural effects in evaporation-proton spectra), and variations of the gamma strength functions with spin and temperature which directly affect deexcitation of CN following particle emission.

8001 (DOE/ER/40330–50) **Nuclear structure from radioactive decay: Annual progress report.** Wood, J.L. Georgia Inst. of Tech., Atlanta, GA (United States). School of Physics. 30 Sep 1991. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-87ER40330. Order Number DE92003673. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses nuclear structure from radioactive decay of the following: Neutron-Deficient Iridium Isotopes; Neutron-Deficient Platinum Isotopes; Neutron-Deficient Gold Isotopes; Neutron-Deficient Mercury Isotopes; Neutron-Deficient Thallium Isotopes; Neutron-Deficient Lead Isotopes; Neutron-Deficient Samarium Isotopes; Neutron-Deficient Promethium Isotopes; Neutron-Deficient Neodymium Isotopes; and Neutron-Deficient Praseodymium Isotopes. Also discussed are Nuclear Systematics and Models.

8002 (DOE/ER/40405–T4) **Nuclear structure studies at intermediate energies: Progress report, July 1990–July 1991.** Hintz, N.M. Minnesota Univ., Minneapolis, MN (United States). School of Physics and Astronomy. Jul 1991. 31p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER40405. Order Number DE92004332. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the following topics: development of (p, 2p) coincidence studies at MRS; analysis of ^{206,207,208}Pb(p, p′) data from E855; and computer program development.

8003 (DOE/ER/40405–T5) **Nuclear structure studies at intermediate energies: Summary progress report, 1987–1990.** Hintz, N.M. Minnesota Univ., Minneapolis, MN (United States). School of Physics and Astronomy. Jul 1990. 154p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER40405. Order Number DE92004109. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the following topics: Search for dibaryon resonances; analysis of ^{208}Pb($\pi^{\pm}$,$\pi^{\pm}$) data; analysis of ^{206,207,208}Pb(p,p′) data; study of transition nuclei by (p,p′); search for recoil free δ-production; search for low lying magnetic states; proton nucleus scattering and swelling of nucleons; measurement of spin observables in ^{28}Si(p,p′); strength of tensor force in nuclei; global analysis of (p,p′) reactions to high spin states in ^{28}Si and ^{58}Ni and density dependent modifications; MRS Setup and development; and development of coincidence studies with the MRS.

8004 (DOE/ER/40561–15) **Models of fragmentation phenomena based on the symmetric group S_n and combinational analysis.** Mekjian, A.Z. (Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory); Lee, S.J. Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory; Rutgers–the State Univ., Piscataway, NJ (United States). Dept. of Physics and Astronomy. 29 Jan 1991. 41p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract FG06-90ER40561. Grant 89-03457. Order Number DE92004368. Source: OSTI; NTIS; INIS; GPO Dep.

Various models for fragmentation phenomena are developed using methods from permutation groups and combinational analysis. The appearance and properties of power laws in these models are discussed. Various exactly soluble cases are studied.

8005 (DOE/ER/40561–17) **The classical EMC effect from few-body systems to nuclear matter: Can binding effects explain it?.** Ciofi degli Atti, C. (Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory); Liuti, S. Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory. 14 May 1991. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-90ER40561. Order Number DE92004370. Source: OSTI; NTIS; INIS; GPO Dep.

It is shown that if the effects of nucleon binding on deep inelastic scattering are considered within many-body realistic descriptions of nuclei which include nucleon-nucleon correlations, the EMC effect in light and medium weight nuclei and nuclear matter can be accounted for in the region $0.2 \leq x \leq 0.5$, but a systematic discrepancy between theory and experiment remains to be explained for $0.5 \leq x \leq 0.9$.

8006 (DOE/ER/40640–1) **Theoretical studies in nuclear structure: Progress report, June 1, 1991–November 30, 1991.** Marshalek, E.R. Notre Dame Univ., IN (United States). Nov 1991. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-91ER40640. Order Number DE92004025. Source: OSTI; NTIS; INIS; GPO Dep.

In this period, the work has centered on two topics. The first is the study of a novel type of collective rotation in which an atomic nucleus with an inversion-symmetric shape rotates uniformly about an axis that is not a principal axis of the quadrupole tensor of the density distribution. This mode is referred to as tilted rotation. By using the cranking model together with higher-order corrections, it was shown that tilted rotation is indeed possible, not only within a microscopic framework, but also within the framework of collective models such as the IBM. The maximum tilt angle of $\pi/4$ is realized for a certain class of states in the U(5) limit. The second topic, which actually was suggested during the course of the first investigation, is concerned with a new way of representing collective harmonic-oscillator algebras using boson-mapping techniques. In this approach, the many-phonon eigenvectors of a $2\lambda+1$-dimensional oscillator having good angular momentum are represented by simple products of boson operators acting on a vacuum. This representation may simplify the calculation of reduced matrix elements of arbitrary operators in collective models, but more work needs to be done.

8007 (IC–91/29) **6p-2h core excitations in ^{20}O.** Amusa, A. International Centre for Theoretical Physics, Trieste (Italy). Feb 1991. 37p. Order Number DE92615304. Source: OSTI; NTIS (US Sales Only); INIS.

The effects of intruder states arising from general positive deformations on the excitation energies, the two-neutron transfer spectroscopic amplitudes for the reaction $^{18}O(t,p)^{20}O$, and some electric quadrupole transition amplitudes between some low-lying positive parity states in ^{20}O are presented. The Hamiltonian matrix elements that reproduce experimental data best are also presented along with a general comparison of the results with experiment and with pure $(sd)^4$ shell model results. (author). 19 refs, 2 figs, 5 tabs.

8008 (INIS-BR–2847, pp. 40-41) **Utilization of CV-28 for fast neutrons production.** Antunes, L.J.; Auler, L.T. Instituto de Engenharia Nuclear (IEN), Rio de Janeiro, RJ (Brazil). 1984. 279p. (In Portuguese). In *Annual technical report IEN - 1983.* Order Number DE92611994. Source: OSTI; NTIS (US Sales Only); INIS.

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8009 (INIS-mf–13026, pp. 7-8) **γ-process contribution to abundance of ^{180}Ta.** Sood, P.C. (Banaras Hindu Univ., Varanasi (India). Dept. of Physics); Sheline, R.K.; Hoff, R.W.; Jain, A.K. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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8010 (INIS-mf–13026, pp. 9-10) **An empirical model for 3QP rotational bands.** Jain, Kiran (Roorkee Univ. (India). Dept. of Physics); Jain, A.K. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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8011 (INIS-mf–13026, pp. 11-12) **High spin states and superdeformation.** Agrawal, Bijay. (Institute of Physics, Bhubaneswar (India)); Praharaj, C.R. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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8012 (INIS-mf–13026, pp. 13-14) **Yrast traps in ^{152}Er.** Rajasekaran, M. (Madras Univ. (India). Dept. of Nuclear Physics); Caleb Chanthi Raj, D. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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8013 (INIS-mf–13026, pp. 21-22) **Structure of doubly odd isotope ^{82}Br.** Sahu, R. (Berhampur Univ. (India). Dept. of Physics); Pandya, S.P. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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8014 (INIS-mf–13026, pp. 23-24) **Magnetic moments in cranked HFB approach.** Saha, M. (Saha Inst. of Nuclear Physics, Calcutta (India)); Sen, S. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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8015 (INIS-mf–13026, pp. 25-26) **Effective single-particle energies in the f-p shell.** Potbhare, V. (Maharaja Sayajirao Univ., Baroda (India). Dept. of Physics); Tressler, N. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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8016 (INIS-mf–13026, pp. 29-30) **On the controversy of $B_{\Lambda\Lambda}$ data of $_{\Lambda\Lambda}{}^{6}$He and $_{\Lambda}$-Λ^{10}Be.** Shoeb, M. (Aligarh Muslim Univ. (India). Dept. of Physics); Usmani, Q.N. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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8017 (INIS-mf–13026, pp. 33-34) **Signature effects in odd-Yb isotopes.** Praharaj, C.R. (Institute of Physics, Bhubaneshwar (India)); Rath, A.K. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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8018 (INIS-mf–13026, pp. 37-38) **Modified rotation vibration model for ^{194}Pt nucleus.** Varshney, A.K. (Aligarh Muslim Univ. (India). Z.H. Coll. of Engineering and Technology); Prasad, R.; Tyagi, R.K.; Gupta, D.K.; Gupta, K.K. Department of Atomic

Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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8019 (INIS-mf–13026, pp. 39-40) **High spin states B(E2) values in ^{78}Kr nucleus.** Varshney, A.K. (Aligarh Muslim Univ. (India). Z.H. Coll. of Engineering and Technology); Prasad, R.; Tyagi, R.K.; Gupta, K.K.; Varshney, V.P.E.; Gupta, D.K. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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8020 (INIS-mf–13026, pp. 43-44) **Coriolis coupling in doubly-odd rotational bands.** Jain, K. (Roorkee Univ. (India). Dept. of Physics); Jain, A.K. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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8021 (INIS-mf–13026, pp. 45-46) **Coriolis effects in 2qp rotational bands of even-even nuclei.** Goel, A. (Roorkee Univ. (India). Dept. of Physics); Jain, A.K. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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8022 (INIS-mf–13026, pp. 47-48) **Microscopic study of high-spin yrast spectra in doubly even cadmium isotopes.** Mattu, P.K. (Jammu Univ. (India). Dept. of Physics); Khosa, S.K. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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8023 (INIS-mf–13026, pp. 49-50) **Coriolis corrections in quadrupole moments of odd-odd nuclei.** Sharma, S.D. (Punjabi Univ., Patiala (India). Dept. of Physics); Sharma, A.; Sharma, P. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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8024 (INIS-mf–13026, pp. 15-16) **Study of beta softness in ^{158}Dy.** Gupta, J.B. (Ramjas College, University of Delhi (India)); Mittal, H.M. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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8025 (INIS-mf–13026, pp. 17-18) **Samarium isotopes in gIBM: weak coupling calculations.** Devi, Y.D. (Physical Research Lab., Ahmedabad (India)); Kota, V.K.B. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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8026 (INIS-mf–13026, pp. 19-20) **IBM and the dynamic HF fermion basis for Zn isotopes.** Sarangi, S. (Physical Research Lab., Ahmedabad (India)); Parikh, J.C. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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8027 (INIS-mf–13026, pp. 31-32) **Validity of the multi-particle shell-model with two-body effective interaction.** Gambhir, Y.K. (Indian Inst. of Tech., Bombay (India). Dept. of Physics); Monti, F.; Bonsignori, G; Savoia, M. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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8029 (INIS-mf–13026, pp. 1-2) **Feeding time and half-lives of excited nuclear states in ^{40}K.** Jain, H.C. (Tata Inst. of Fundamental Research, Bombay (India)); Chattopadhyay, S.; Agarwal, Y.K.; Dasgupta, M.; Jhingan, M.L.; Roy, A. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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8030 (INIS-mf–13026, pp. 3-4) **High spin isomer in ^{151}Sm.** Chatterjee, J.M. (Saha Inst. of Nuclear Physics, Calcutta (India)); Basu, Somapriya; Kar, K; Banik, D.; Chattopadhyay, R.K.; Sharma, R.P.; Pardhasaradhi, S.K. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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8031 (INIS-mf–13026, pp. 41-42) **Spectroscopy of high spin states in ^{92}Mo.** Singh, P. (Tata Inst. of Fundamental Research, Bombay (India)); Pillay, R.G.; Devare, H.G. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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8032 (INIS-mf–13026, pp. 209-210) **Superdeformation and nucleon emission spectra of ^{28}Si.** Rajasekaran, M. (Madras Univ. (India). Dept. of Nuclear Physics); Rajasekaran, T.R. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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8033 (INIS-mf–13026, pp. 231-232) **Non-existence of superluminosity of speed of sound in nuclear matter.** Das, B.K. (Sambalpur Univ., Burla (India)); Satpathy, R.K. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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8034 (INIS-mf–13026, pp. 235-236) **Hot nuclear matter in a chirally invariant fermionic field theory.** Chowdhury, S.K. (Indian Association for the Cultivation of Science, Calcutta (India). Dept. of Theoretical Physics); Sarkar, S. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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8035 (INIS-mf–13026, pp. 229-230) **Application of Thomas-Fermi theory for finite systems.** Uma Maheswari, V.S. (Institute of Physics, Bhubaneswar (India)); Ramamurthy, V.S.; Satpathy, L. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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8036 (INIS-mf–13026, pp. 285-286) **Exotic boson mappings.** Gambhir, Y.K. (Indian Inst. of Tech., Bombay (India). Dept. of Physics). Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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8037 (JINR-E–1-90-284) **High statistics measurement of the deuteron structure functions $F_2(x,Q^2)$ and R from deep inelastic muon scattering at high Q^2.** Benvenuti, A.C. (and others); Bollini, F.; Bruni, G. Joint Inst. for Nuclear Research, Dubna (USSR). 1990. 14p. Order Number DE92609795. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Phys. Lett., B.

Results on a high statistics study of the nucleon structure functions $F_2(x, Q^2)$ and $R=\sigma_L/\sigma_T$ measured in deep inelastic scattering of muons on a deuterium target are given. The analysis is based on $8x10^5$ events after all cuts, recorded at beam energies of 120,200 and 280 GeV in the kinematic range $0.06 \leq x \leq 0.80$ and 8 $\mathrm{GeV}^2 \leq Q^2 \leq 260\ \mathrm{GeV}^2$. Scaling violations observed in the data are in agreement with predictions of perturbative QCD and allow one to determine the QCD mass scale parameter Λ. 22 refs.; 4 figs.; 6 tabs.

8038 (Juel–2453) **Shape changes in the nucleus ^{180}Os at high angular moments.** Schnare, H. Forschungszentrum Juelich GmbH (Germany). Inst. fuer Kernphysik; Bonn Univ. (Germany). Mar 1991. 139p. (In German). Order Number DE92758894. Source: OSTI; NTIS (US Sales Only); INIS.

For the study of the shape changes in the nucleus ^{180}Os at high angular momenta high-spin states were excited in a ^{150}Nd(^{36}S,6n) compound-nucleus reaction. The emitted γ radiation was measured with the 12 anti-Compton spectrometers and the γ calorimeter of the OSIRIS apparature. In the $E\gamma E\gamma$ correlation matrices in the energy range 660-860 keV and above 900 keV peak structures were observed from which the dynamic moment of inertia of the nucleus could be derived. (orig./HSI).

8039 (KURRI-TR–345, pp. 3-15) **Fine structures in nuclear charge distribution of fission yield.** Zukeran, Atsushi (Hitachi Ltd., Ibaraki (Japan). Energy Research Lab.). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Mar 1991. (CONF-9008225–: Specialists' meeting on physics and engineering of fission and spallation; Specialists' meeting on physics and engineering of fission and spallation, Kumatori (Japan); Kumatori (Japan), 2 Aug 1990; 10 jan 1991; CONF-9101117–). In *Proceedings of the specialists' meeting on physics and engineering of fission and spallation, 1990.* 118p. Order Number DE92713857. Source: OSTI; NTIS (US Sales Only); INIS.

The nuclear charge distribution function is derived from statistical theory as a function of the most probable charge transfer variable defined by the difference between the most stable charges of fission fragments. The fine structures observed in the charge distribution width, skewness and excess can be described by the present formula in terms of a charge shift parameter due to shell and pairing effects. The charge shifts from simple liquid drop model are obtained from the mass formula based on shell model. Resultant fine structure constants have finer structures than experimental data although general trends can be reproduced by present theory. (author).

8040 (LA-UR-91-3497) **Exploration of the neutron-rich mass surface from ^{11}Li to ^{66}Fe.** Vieira, D.J. (Los Alamos National Lab., NM (United States)); Wouters, J.M.; Butler, G.W.; Seifert, H.L.; Zhou, Z.Y.; Zhou, X.G.; Tu, X.L.; Lind, V.G.; Loebner, K.E.G. Los Alamos National Lab., NM (United States). [1991]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-9106196-4: Nuclear shapes and nuclear structure at low excitation energies, Cargese (France), 3-7 Jun 1991). Order Number DE92003796. Source: OSTI; NTIS; INIS; GPO Dep.

A small revolution in our ability to perform mass measurements of light-mass, neutron-rich nuclei has occurred during the last five years with the extension of the direct, total mass measurement method to fast recoiling nuclei. To date the work of two groups, one using the SPEG spectrometer at GANIL and the other using the TOFI spectrometer at LAMPF, has yielded over 85 mass measurements of which 62 had not been reported previously. Extending from the neutron-halo nucleus ^{11}Li up to ^{66}Fe, a region relevant to the astrophysical r-process, these measurements have provided a valuable first glimpse into the interesting nuclear structure present in many of these exotic nuclei. Herein we highlight the nuclear structure insight which as been gained from these measurements, especially that learned from a comparison to recent shell model calculations. Attention is given to: (1) the binding of loosely-bound neutron halo nuclei; (2) the N=14–16 region in the neutron-rich isotopes of O, F, and Ne where the strong two-body interaction plays an important role; (3) the deformed intruder state region around ^{31}Na of long standing interest; (4) the neutron-rich isotopes of sulfur and chlorine; and (5) the question of the isospin dependence (or independence) of neutron and proton pairing energies in the fp shell. Only the briefest account of this work can be given here; emphasis is placed on the most recent results. 24 refs., 3 figs.

8041 (LA-UR-91-3719) **SU(3) symmetries in exotic neutron-rich nuclei.** Hayes, A.C. Los Alamos National Lab., NM (United States). [1991]. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-9105291-1: Exotic neutron-rich nuclei, Darmstadt (Germany), 5-7 May 1991). Order Number DE92003870. Source: OSTI; NTIS; INIS; GPO Dep.

We examine the structure of the exotic neutron-rich nucleus ^{11}Li with an emphasis on understanding the origin of the soft E1 resonance and the neuron halo. The similarities and differences between shell model and di-neutron cluster model descriptions of the system are displayed using the Hecht expansion techniques. We find that the ground state ^{11}Li as described in large shell model calculations is well approximated by the di-neutron cluster state. In contrast to the ground state, the soft E1 model of ^{11}Li appears to have a more complicated structure and the E1 strength of this resonance is very sensitive to cancellations between p→s and p→d contributions to the dipole matrix elements. 12 refs., 6 figs., 3 tabs.

6632 Radioactivity and Electromagnetic Transitions (Excluding Fission)

Refer also to citation(s) 8001

8042 (INDC(CCP)-338/L) **Radiation and decay characteristics of long-lived radionuclides used in the national economy and scientific research (evaluated data): A handbook.** Chechev, V.P.; Chukreev, F.E. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Oct 1991. 40p. Translated from Russian by the IAEA. Order Number DE92615309. Source: OSTI; NTIS (US Sales Only); INIS.

This handbook contains new evaluated data for a series of radionuclides distributed by the All-Union Organization "Izotop". It is intended for use by the wide range of scientists and engineers using these isotopes in their work. (author). 13 refs.

8043 (INIS-mf-13026, pp. 5-6) **Measurement of K electron capture decay probability in ^{161}Ho, ^{125}I and ^{131}Ba.** Sree Krishna Murty, G. (Andhra Univ., Visakhapatnam (India). Labs. for Nuclear Research); Chandrasekhar Rao, M.V.S.; Ravi Kumar, M.; Satyanarayana, G.; Sastry, D.L.; Chintalapudi, S.N. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123-: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. BARIUM 131/k capture; HOLMIUM 161/k capture; IODINE 125/k capture; ALPHA REACTIONS; ANTIMONY 123 TARGET; CESIUM 131; COINCIDENCE SPECTROMETRY; ENERGY-LEVEL TRANSITIONS; EXPERIMENTAL DATA; GAMMA SPECTRA; MEV RANGE 10-100; NEUTRONS; TERBIUM 159 TARGET; X-RAY SPECTRA

8044 (INIS-mf-13026, pp. 223-224) **Disintegration of heavy hypernuclei.** Goswami, K. (Goalpara College (India). Dept. of Physics); Goswami, T.D. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123-: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. 5 refs. HYPERNUCLEI/nuclear decay; NUCLEAR DECAY/kaon minus reactions; BROMINE; GEV RANGE 01-10; HYPERNUCLEI; HYPERONS; MESONS; NUCLEAR EMULSIONS; SILVER

8045 (JINR-E-3-90-45) **Intensities of two-quanta cascades at different excitation energies of compound nuclei ^{146}Nd, ^{174}Yb, ^{183}W.** Boneva, S.T.; Khitrov, V.A.; Sukhovoj, A.M.; Vojnov, A.V. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics. 1990. 14p. Order Number DE92609950. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Z. Phys., A: At. Nuclei.

Intensities of two-quanta cascades are obtained for 2-3 final low-lying levels of the following nuclei ^{146}Nd, ^{174}Yb and ^{183}W. These measured intensities are compared with the intensities calculated in the frame of various models at primary transition energies ranging from 0.5 MeV to the neutron binding energy. Some excitation energy intervals are revealed, experimentally obtained intensities of cascade are inconsistent with model calculations. 15 refs.; 7 figs.

6633 Nuclear Reactions and Scattering, General

Refer also to citation(s) 8324

8046 (IC-91/167) **Nuclear inelastic scattering cross-section for transitions L=2 and 3 in the strong absorption model.** Rahman, M.A. (International Centre for Theoretical Physics, Trieste (Italy)); Sen Gupta, H.M. International Centre for Theoretical Physics, Trieste (Italy). Jul 1991. 7p. Order Number DE92614308. Source: OSTI; NTIS (US Sales Only); INIS.

Austern and Blair have established the connection between inelastic and elastic nuclear scattering of strongly absorbed particles in the adiabatic approximation. Simple closed expressions again in the adiabatic approximation, under strong absorption condition, for the inelastic scattering cross-section are obtained and made explicit by Potgieter and Frahn; which are analogous to the strong absorption model formulae for elastic scattering. We derive the inelastic scattering cross-section for transitions L = 2 and 3 using their general formulations and test the derived formulae with experiments. (author). 6 refs, 1 fig.

8047 (INDC(CPR)-024/L, pp. 5-7) **Research on the covariance matrix of the evaluated data.** Wang Zisheng (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy); Cai Dunjiu. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Oct 1991. In *Evaluation of cross-sections for dosimetry reactions: Final report to the IAEA for the contract 5516, 1989-1991.* 67p. Order Number DE92615328. Source: OSTI; NTIS (US Sales Only); INIS.

This work, through comparing the weighted average values for experimental data with the recommended average ones in a variety of small energy interval that group the sets of reaction cross sections, obtains a system of linear equations for the adjusted factors generated by alteration for the experimental data, which makes it possible to solve the question of covariance for the evaluated data considering all physical alteration. The covariance matrices of some dosimetry reaction cross sections are calculated by this method. 5 refs.

8048 (INIS-mf–13026, pp. 259-260) **Coulomb energy and mass yields in nuclear multifragmentation process.** Mishra, M. (Institute of Physics, Bhubaneswar (India)); Satpathy, L. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. NUCLEAR FRAGMENTS/coulomb energy; PROTON REACTIONS/nuclear fragmentation; ASYMMETRY; BINDING ENERGY; COULOMB FIELD; ENERGY DEPENDENCE; MASS NUMBER; MEV RANGE 01-10; NUCLEAR MODELS; NUCLEAR REACTION YIELD

8049 (KEK–90-25(v.1), pp. 291-299) **Spallation physics: An overview.** Russell, G.J. (Los Alamos National Lab., NM (United States)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

Most of you know that LANSCE uses 800-MeV protons (from LAMPF) to produce neutrons for scattering experiments. But do you know how we do it? This article explains the basics of spallation and compares it to fission, and discusses some basic target neutronics. (author).

8050 (KEK–90-25(v.1), pp. 300-318) **Calculation code system for fission and spallation products.** Nishida, T. (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Takada, H.; Nakahara, Y.; Kanno, I.; Tsutsui, T.; Kaneko, Y. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

It is important to use computer codes with high precision for analyzing the physical process in the intense neutron source induced by the high energy proton beam. A brief description is given for the spallation and fission reactions and the particle transport codes which have been developed and upgraded at JAERI. The simulation code for High Energy Nuclear Reaction Process in the energy range of 15 MeV to 3 GeV, NMTC/JAERI, is a JAERI version of NMTC which was developed at ORNL and revised later at LANL and BNL. In this version the high energy fission reaction can be calculated, using the statistical model, in competition with the particle evaporation reaction. The mass number A of nuclides which can be dealt in the spallation calculation has been extended from [A=1;8<A<239] to [A=1;6<A<250]. A simulation code NUCLEUS for the spallation reaction of one nucleus without taking into account the internuclear cascade, was also developed to evaluate the computational model for spallation reaction and analyze effectively the data measured in thin foil experiments. For the whole energy range less than 3 GeV, two simulation code systems had been developed by connecting NMTC/JAERI with the neutron transport codes MORSE-DD and TWOTRAN-II respectively. The code SPCHAIN for calculating the time evolution process of spallation products has been developed on the base of the depletion code DCHAIN2, which had been made for the calculations of decay and built-up of fission products in a nuclear reactor. The new nuclear data have been compiled in SPCHAIN data file for about 1100 nuclides needed for TRU spallation calculation. These codes are used to calculate reaction products measured in the spallation experiment using 500 MeV protons in the booster facility of the synchrotron at KEK and to perform the conceptual design study of TRU transmutation system driven by an intense proton accelerator. (author).

8051 (KEK–90-25(v.1), pp. 354-361) **Measurement of neutron activation cross sections by p-Be semi-monoenergetic neutrons.** Nakamura, T. (Tohoku Univ., Sendai (Japan). Cyclotron and Radioisotope Center); Sugita, H.; Kondo, Y.; Uwamino, Y.; Imamura, M. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

Neutron activation cross sections of C, Na, Mg, Al, Si, Ca, V, Cr, Mn, Cu, Zn and Au, which are mostly constituents of accelerator and building materials, in the energy range of 10 to 40 MeV, by using semi-monoenergetic neutrons from the Be(p,n) reaction. A proton beam of energies of 20, 22.5, 25, 27.5, 30, 32,5, 35, 37.5 and 40 MeV hits the 1-mm and 2-mm thick Be targets which are backed by the water coolant. The induced gamma-ray activities of the irradiated samples were measured with a pure Ge detector and of long-lived ^{26}Al were done by accelerator mass spectrometry. The activation cross section data could be obtained by unfolding technique. (author).

6634 Specific Nuclear Reactions and Scattering

Refer also to citation(s) 7469, 7868, 7935, 7942, 7959, 7966, 7967, 7996, 8002, 8233

8052 (ANL/CP–73902) **Fast-neutron total and scattering cross sections of ^{58}Ni and nuclear models.** Smith, A.B.; Guenther, P.T.; Whalen, J.F.; Lawson, R.D.; Chiba, S. Argonne National Lab., IL (United States). [1991]. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-9111146–1: Meeting of coordinate research program on long lived radionuclides for fusion, Vienna (Austria), 11-12 Nov 1991). Order Number DE92004000. Source: OSTI; NTIS; INIS; GPO Dep.

An extensive experimental and theoretical study of the fast-neutron interaction with ^{58}Ni was undertaken. The neutron total cross sections of ^{58}Ni were measured from $\approx$ 1 to $>$ 10 MeV using white source techniques. Differential neutron elastic-scattering cross sections were measured from $\approx$ 4.5 to 10 MeV at $\approx$ 0.5 Mev intervals with $\geq$ 75 differential values per distribution. Differential neutron inelastic-scattering cross sections were measured, corresponding to fourteen levels with excitations up to $\approx$ 4.8 Mev. The measured results, combined with lower-energy values previously obtained at this laboratory and with relevant values available in the literature, were interpreted in terms of optical-statistical, dispersive-optical and coupled-channels models using both vibrational and rotational coupling schemes. The physical implications of the experimental results and their interpretation are discussed. The considerations are being extended to collective vibrational nuclei generally, exploring the potential for utilizing electro-magnetic matrix elements, deduced from experiment or predicted by the shell model, to determine the strengths of the neutron interaction. Detailed aspects of this work are given in the Laboratory Report, ANL/NDM-120 (in press). 9 refs., 10 figs.

8053 (CNIC–00421) **Charge distribution in the spontaneous fission of ^{252}Cf: Determination of fractional cumulative yields of ^{133m}Te and ^{123g}Te.** Zhang Yanling (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy); Li Xueliang; Wang Fangding. China Nuclear Information Centre, Beijing, BJ (China). Nov 1990. 12p. (In Chinese). (IAE–0079.). Order Number DE92614377. Source: OSTI; NTIS (US Sales Only); INIS.

The fractional cumulative yields (FCY) of ^{133m}Te and ^{133G}Te in the spontaneous fission of ^{252}Cf have been determined by the radiochemical method. The values are 0.533 $\pm$ 0.014 and 0.291 $\pm$ 0.042 respectively. The ratio of fractional independent yield of ^{133m}Te to ^{133g}Te was found to be R = 3.5 by using the measured fractional cumulative yields of ^{133m}Te and ^{133g}Te. From these results the initial fragment angular momentum of root-mean-square of ^{133}Te has been deduced. The FCY of $^{133m+g}$Te determined in this work is in good agreement with the expectation value derived from Wahl's system-atics of nuclear charge distribution in the fission. In the mass region of A 131$\approx$141, there is no obvious effect of N = 82 neutron shell and proton pairing effects on the nuclear charge distribution.

8054 (CNIC–00423) **Charge distribution in the spontaneous fission of ^{252}Cf: Determination of cumulative yields of**

^{127g}Sn and ^{128}Sn. Zhao Xin (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy); Li Xueliang; Guo Jingru. China Nuclear Information Centre, Beijing, BJ (China). Jul 1990. 12p. (In Chinese). (IAE–0080.). Order Number DE92614378. Source: OSTI; NTIS (US Sales Only); INIS.

The cumulative yields (CY) of ^{127g}Sn and ^{128}Sn in the spontaneous fission of ^{252}Cf have been determined by the radiochemical method. The values are (0.0437 ± 0.0021)% and (0.145 ± 0.007)% respectively. The cumulative yield of ^{128}Sn determined in this work is lower than the expectation value (0.164%) obtained by the empirical Z_p model but in good agreement with the expectation value (0.145%) according to empirical A_p' model. Both the yield of ^{128}Sn measrued and the yields of Tc and In measured in the thermal neutron-induced fission of ^{235}U have shown that the empirical A_p' model is better than Z_p model in representing nuclear charge distribution near the symmetrical range in fission.

8055 (CONF-911113–1) **A dynamical string-Parton model for relativistic heavy-ion collisions.** Umar, A.S. (Vanderbilt Univ., Nashville, TN (United States). Dept. of Physics and Astronomy); Dean, D.J.; Strayer, M.R. Oak Ridge National Lab., TN (United States). [1991]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 9. international conference on ultra relativistic nucleus-nucleus collisions; Gatlinburg, TN (United States); 11 Nov 1991. Order Number DE92005159. Source: OSTI; NTIS; INIS; GPO Dep.

We introduce a new model for simulating the hadronic phenomena at relativistic heavy-ion colliders. The model is based on dynamical Nambu strings with extensions to include the essential features of the Parton model. The 3+1 dimensional calculations are performed for various systems, including the leading quark attenuation in μ-A, and A-A results from NA35 and WA80.

8056 (CONF-9103119–4) **Preliminary measurements of shadowing at very low X_{Bj}.** Jaffe, D.E. Fermilab E665 collaboration. Illinois Univ., Chicago, IL (United States). [1991]. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76ER02289. From Moriond meeting on high energy hadronic interactions; Les Arcs (France); 17-23 Mar 1991. Order Number DE92004289. Source: OSTI; NTIS; INIS; GPO Dep.

The ratio of cross sections for deeply inelastic muon scattering on xenon and deuterium nuclei was measured at very low X_{Bj} (.00002 $< X_{Bj} <$ .25) for .01 $< Q^2 <$ 60 $(GeV/c)^2$. The data were taken at Fermilab experiment E665 with an average muon beam energy of 490 GeV incident on 1.1 meter long deuterium and xenon target vessels. Two largely independent analysis techniques gave statistically consistent results and show a smooth decrease in the ratio of the xenon-to-deuterium per-nucleon cross sections from ~ 1 to ~ 0.7 as X_{Bj} decreases from ~ 0.1 to ~ 0.002. In the X_{Bj} range 0.00002 to 0.002, the ratio remains roughly constant at ~ 0.7.

8057 (DOE/ER/40246–6) **Neutron scattering studies in the actinide region: Progress report, August 1, 1988–July 31, 1991.** Beghian, L.E.; Kegel, G.H.R. Lowell Univ., MA (United States). Radiation Lab. Aug 1991. 44p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER40246. Order Number DE92004418. Source: OSTI; NTIS; INIS; GPO Dep.

During the report period we have investigated the following areas: Neutron elastic and inelastic scattering measurements on ^{14}N, ^{181}Ta, ^{232}Th, ^{238}U and ^{239}Pu; Prompt fission spectra for ^{232}Th, ^{235}U, ^{238}U and ^{239}Pu; Theoretical studies of neutron scattering; Neutron filters; New detector systems; and Upgrading of neutron target assembly, data acquisition system, and accelerator/beam-line apparatus.

8058 (DOE/ER/40343–5) **Investigation of pion-nucleus interactions: Progress report, April 1, 1990–March 31, 1991.** Moore, C.F. Texas Univ., Austin, TX (United States). Dept. of Physics. Sep 1991. 34p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-87ER40343. Order Number DE92004061. Source: OSTI; NTIS; INIS; GPO Dep.

The double isovector giant state has been observed in the (π^-, π^+) $\Delta T_z = +2$ double-charge-exchange reaction on ^{13}C, ^{27}Al, ^{40}Ca, ^{56}Fe, ^{59}Co, and ^{93}Nb. The resonances observed in the (π^-, π^+) reaction are closely related via Coulomb displacement energy and isospin symmetry to the resonances measured in the inverse (π^+, π^-) reaction on the same nuclei. The new observations provide a direct determination of the upper isospin component of the double giant dipole state, which is generally very weak in the (π^+, π^-) reaction. The comparison between the double dipole in the two double-charge-exchange modes gives valuable information on the isospin splitting and the Pauli-blocking effects for isotensor transitions.

8059 (DOE/ER/40353–9) **Proton resonance spectroscopy: Progress report, December 1, 1990–November 30, 1991.** Shriner, J.F. Jr. Tennessee Technological Univ., Cookeville, TN (United States). Dept. of Physics. Nov 1991. 28p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-87ER40353. Order Number DE92004059. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the following topics: Complete Level Scheme for ^{30}P; A Search for Resonances Suitable for Tests of Detailed-Balance Violation; The Fourier Transform as a Tool for Detecting Chaos; Entrance Channel Correlations in p + ^{27}Al; The Parity Dependence of Level Densities in ^{49}V; and A Computer Program for the Calculation of Angular Momentum Coupling.

8060 (DOE/ER/40403–T3) **Experimental studies of pion-nucleus interactions at intermediate energies: Annual progress report.** New Mexico State Univ., Las Cruces, NM (United States). 31 Dec 1991. 34p. Sponsored by U.S. DOE Energy Research. DOE Contract FG04-88ER40403. Order Number DE92004819. Source: OSTI; NTIS; INIS; GPO Dep.

This report summarizes the work on experimental research in intermediate energy nuclear physics carried out at New Mexico State University in 1991 under a great from the US Department of Energy. Most of these studies have involved investigations of various pion-nucleus interactions. The work has been carried out both with the LAMPF accelerator at the Los Alamos National Laboratory and with the cyclotron at the Paul Scherrer Institute (PSI) near Zurich, Switzerland. Part of the experimental work involves measurements of new data on double-charge-exchange scattering, using facilities at LAMPF which we helped modify, and on pion absorption, using a new detector system at PSI that covers nearly the full solid-angle region which we helped construct. Other work involved preparation for future experiments using polarized nuclear targets and a new high-resolution spectrometer system for detecting π^0 mesons. We also presented several proposals for works to be done in future years, involving studies related to pi-mesonic atoms, fundamental pion-nucleon interactions, studies of the difference between charged and neutral pion interactions with the nucleon, studies of the isospin structure of pion-nucleus interactions, and pion scattering from polarized ^{3}He targets. This work is aimed at improving our understanding of the pion-nucleon interaction, of the pion-nucleus interaction mechanism, and of nuclear structure.

8061 (DOE/ER/40410–3) **[Electromagnetic studies of nuclear structure and reactions]: Progress summary, [January 1, 1991–December 31, 1991].** New Hampshire Univ., Durham, NH (United States). [1991]. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER40410. Order Number DE92005088. Source: OSTI; NTIS; INIS; GPO Dep.

The past year has seen continued progress in our efforts. On the experimental side, we completed data acquisition on our major remaining involvement at NIKHEF, the ^{12}C(e,e′pp) experiment. We advanced the analysis of most of projects in low lying nuclear structure and giant resonances, of which several were completed and published. We received approval for several new experiments, and have made major contributions to design and development of detectors to be used at Bates and CEBAF. Our data interpretation efforts have been extended and enhanced with the availability of our new computer cluster. In this paper we briefly report on most of these efforts.

8062 (DOE/ER/40415–7) **Medium energy nuclear physics research: Progress report, July 1, 1987–September 30, 1988.** Peterson, G.A.; Dubach, J.F.; Hicks, R.S.; Miskimen, R.A. Massachusetts Univ., Amherst, MA (United States). Sep 1988. 46p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER40415. Order Number DE92005084. Source: OSTI; NTIS; INIS; GPO Dep.

The UMass group has concentrated on using electromagnetic probes, particularly the electron in high-energy scattering experiments at the Stanford Liner Accelerator Center (SLAC). Plans are also being made for high energy work at the Continuous Beam Accelerator Facility (CEBAF). The properties of this accelerator should permit a whole new class of coincidence experiments to be carried out. At SLAC UMass has made major contributions toward the plans for a cluster-jet gas target and detector system at the 16 GeV PEP storage ring. For the future CEBAF accelerator, tests were made of the feasibility of operating wire drift chambers in the vicinity of a continuous electron beam at the University Illinois microtron. At the same time a program of studies of the nuclear structure of more complex nuclei has been continued at the MIT-Bates Linear Accelerator Center and in Amsterdam at the NIKHEF-K laboratory. At the MIT-Bates Accelerator, because of an unforeseen change in beam scheduling as a result of problems with the T_{20} experiment, the UMass group was able to complete data acquisition on experiments involving 180° elastic magnetic scattering on ^{117}Sn and ^{41}Ca. A considerable effort has been given to preparations for a future experiment at Bates involving the high-resolution threshold electrodisintegration of the deuteron. The use of these chambers should permit a high degree of discrimination against background events in the measurement of the almost neutrino-like small cross sections that are expected. In Amsterdam at the NIKHEF-K facility, single arm (e,e′) measurements were made in November of 1987 on ^{10}B in order to better determine the $p_{3/2}$ wave function from the transition from the $J^{pi} = 3^+$ ground state to the O^+ excited state at 1.74 MeV. In 1988, (e,e′p) coincidence measurements on ^{10}B were completed. The objective was to obtain information on the $p_{3/2}$ wave function by another means.

8063 (DOE/ER/40454–T1) **Partial-wave analyses of hadron scattering below 2 GeV: Progress report May 1991–Aprll 30, 1992.** Arndt, R.A.; Roper, L.D. Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (United States). Dept. of Physics. [1991]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-88ER40454. Order Number DE92005468. Source: OSTI; NTIS; INIS; GPO Dep.

The Center for Analysis of Particle Scattering (CAPS) in the Department of Physics at Virginia Polytechnic Institute and State University has analyzed basic two-body hadron reactions below 2 GeV for the last two decades. Reactions studied were nucleon-nucleon, pion-nucleon, K^+-nucleon and pion photoproduction systems. In addition to analyses of these systems, a computer graphics system (SAID) has been developed and disseminated to over 250 research institutions using VAX computers. The computer-interactive system for disseminating information on basic scattering reactions is also accessible to the physics community through TELNET on the VPI&SU physics department VAX. 6 refs.

8064 (DOE/ER/40561–27) **High energy nuclear quasielastic reactions: Decisive tests of nuclear binding/pion models of the EMC effect.** Frankfurt, L. (Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory); Strikman, M.; Miller, G.A. Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory. [1991]. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-90ER40561 ;FG06-88ER40427. (DOE/ER/40427-25-N91). Order Number DE92004382. Source: OSTI; NTIS; INIS; GPO Dep.

The light-cone nucleon momentum distributions obtained from non- relativistic spectral functions or given by nuclear binding/pion models are often used to analyze high Q^2 quasi-elastic and deep-inelastic (e,e′) reactions. We demonstrate that in such models the presence of non-nucleonic components causes the scattering from forward and backward moving target protons to be significantly different. Other models do not have this property. The sensitivity of current (e,e′p) and (p,pp) color transparency experiments is sufficient to observe these differences.

8065 (FNAL/C–91/325) **Preliminary results from FNAL E665 muon scattering at low x_{Bj}.** Schellman, H. E665 Collaboration. Fermi National Accelerator Lab., Batavia, IL (United States). Nov 1991. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-9107172–10: 15. joint international lepton photon symposium at high energies and European Physical Society (EPS) conference on high energy, Geneva (Switzerland), 25 Jul - 1 aug 1991). Order Number DE92005332. Source: OSTI; NTIS; INIS; GPO Dep.

We present measurements of inelastic muon scattering cross section ratios at very low x_{Bj}. The Xe/D_2 cross section ratio has been measured for x_{Bj} down to 2×10^3. We have also measured the n/p cross section ratio down to $x_{Bj} = 10^3$ and see no significant deviation from unity. 8 refs., 4 figs.

8066 (IAEA-R–5234-F) **Neutron induced gamma-ray production data: Final report for the period 1 October 1988 - 31 October 1991.** Ho Yukun. International Atomic Energy Agency, Vienna (Austria). Nov 1991. 10p. Order Number DE92615322. Source: OSTI; NTIS (US Sales Only); INIS.

The capture reaction mechanisms are classified according to the hierarchy of quasiparticle numbers in the capture configurations - one quasiparticle (channel capture), three quasiparticles (doorway mechanism) and five or more quasiparticles (statistical processes). The nonstatistical effects in the 2 P and 3 S size resonance region of neutron strength function were systematically studied and the mass, shell and even-odd effects were explored. Two computer codes, GRS and GNASH-M, were developed and used for the calculations of neutron-induced photon production data in ^{12}C, ^{16}O, ^{27}Al, ^{28}Si, ^{56}Fe, $^{63-65}$Cu, ^{197}Au and ^{208}Pb at the neutron energy region from thermal to 20 MeV. 12 refs.

8067 (IC–91/130) **(^{6}Li,d) reaction on sd-, fp- and g-shell nuclei in ZR- and FR-DWBA formalisms.** Rahman, M.A. (International Centre for Theoretical Physics, Trieste (Italy)); Mecking, M.; Strohbusch, U. International Centre for Theoretical Physics, Trieste (Italy). Jun 1991. 10p. Order Number DE92614353. Source: OSTI; NTIS (US Sales Only); INIS.

(^{6}Li,d) reaction angular distributions on target nuclei $16 \leq A \leq 90$ have been analyzed using both ZR- and FR-DWBA formalisms. The most prevalent method of analysis of alpha-transfer reactions such as(^{6}Li,d) and its reverse (d, ^{6}Li) (where the wave function at zero distance in the p-state of relative cluster motion in the A = 6 nuclei will not have node) is the ZR-DWBA calculations due to the relatively short time of computation. It is of particular interest to verify whether FR-DWBA calculations result in similar S_α- values to those of ZR-DWBA or not. It is found that to derive similar S_α-values as in FR-DWBA calculations, one requires relatively large real well depth in ZR-DWBA calculations. Qualitative discussions have been made in this direction. (author). 12 refs, 3 figs, 2 tabs.

8068 (IC–91/166) **Strong absorption model analysis of alpha scattering.** Rahman, M.A. (International Centre for Theoretical Physics, Trieste (Italy)); Chandra Paul, S.; Sen Gupta, H.M.; Rahman, M. International Centre for Theoretical Physics, Trieste (Italy). Jul 1991. 16p. Order Number DE92614345. Source: OSTI; NTIS (US Sales Only); INIS.

Angular distribution of alpha-particles at several energies, $E_\alpha = 21 \approx 85.6$ MeV from a number of nuclei between ^{20}Ni and ^{119}Sn, extending to wide angular range up to ≈ 160 deg. C in some cases, have been analyzed in terms of three-parameter strong absorption model of Frahn and Venter. Interaction radius and surface diffuseness are obtained from the parameter values rendering the best fit to the elastic scattering data. The inelastic scattering of alpha-particles from a number of nuclei, leading to quadrupole and octupole excitations has also been studied giving the deformation parameters β_L. (author). 14 refs, 7 figs, 3 tabs.

8069 (INDC(AUS)–014/L) **Update of the evaluation of the cross sections for the neutron-dosimetry reactions ^{19}F(n,2n)^{18}F and ^{93}Nb(n,2n)^{92m}Nb.** Wagner, M. (Vienna Univ. (Austria). Inst. fuer Radiumforschung und Kernphysik). International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Oct 1991. 32p. Order Number DE92615323. Source: OSTI; NTIS (US Sales Only); INIS.

The excitation functions for the reactions ^{19}F(n,2n)^{18}F and ^{93}Nb(n,2n)^{92m}Nb, which are included in the International Reactor Dosimetry File (IRDF-90), were re-evaluated taking into account very recent experimental data. In the case of the reaction ^{19}F(n,2n)^{18}F the new measurements served to extend the neutron energy range beyond 20 MeV; for the ^{93}Nb(n,2n)^{92m}Nb reaction the new information concerning the energy region just above the threshold (9.0 - 10.6 MeV) substantially modified the results of the evaluation and thus the recommended cross sections in this energy region. The cross sections and their uncertainties were evaluated in energy groups with widths of 0.2 MeV to 2.0 MeV, and relative correlation matrices of the evaluated cross sections at the different energies were calculated. The results of the evaluation are compared with those given in the IRDF-90 and, in the case of ^{93}Nb(n,2n)^{92m}Nb, with a model calculation carried out by Strohmaier. The results of this work are intended to replace the corresponding data given in Physics Data 13-5 and the recommended cross sections for these two reactions in the IRDF-90. (author). 23 refs, figs and tabs.

8070 (INDC(BZL)–034/L) **Extension of the ^{232}Th burnup chain in the WIMSD/4 program library.** Caldeira, A.D. (Minsitry of Aeronautics (Brazil). Inst. of Advanced Studies). International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Oct 1991. 8p. Translated by the IAEA. Order Number DE92615324. Source: OSTI; NTIS (US Sales Only); INIS.

In the WIMSD/4 program library the ^{232}Th burnup chain ends at ^{234}U. The purpose of the present work is to extend the chain to ^{236}U by modifying the ^{234}U burnup data in the program library. 3 refs, 3 figs.

8071 (INDC(CCP)–316/L) **Evaluated neutron nuclear data for curium-244.** Klepatskij, A.B. (AN Belorusskoj SSR, Minsk (Belarus). Inst. Yadernoj Ehnergetiki); Kolesov, A.M.; Maslov, V.M.; Porodzinskij, Yu.V.; Sukhovitskij, E.Sh. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Oct 1991. 29p. Order Number DE92615325. Source: OSTI; NTIS (US Sales Only); INIS.

The creation of an evaluated neutron data file for ^{244}Cm is described. Currently available information on the interaction of neutrons with the ^{244}Cm nucleus is analysed. Owing to a lack of experimental data the evaluation relies to a large extent on the use of theoretical models and systematics. The evaluated cross-sections obtained in the 10^{-5} eV - 20 MeV region are compared with evaluations made by other authors. (author). 35 refs, 4 figs, 5 tabs.

8072 (INDC(CCP)–341/LP) **The gross and fine structure of the mass distributions of the fragments in the binary fission of actinides.** Goverdovsky, A.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst.); Mitrofanov, V.F.; Khryachkov, V.A. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Nov 1991. 18p. Order Number DE92615385. Source: OSTI; NTIS (US Sales Only); INIS.

The fission fragments energies and masses characteristics and their correlations have been studied for the fast neutrons induced fission of U-235,236,238. Np-237 and Am-243 (En=16.5 MeV) and cold-hot fragmentation of U-235 (thermal neutrons and 1 MeV), U-236 (1 MeV). New results for reaction Np-237 (n,f) with neutrons from 0.3 to 1.3 MeV (near the barrier top) are presented. 14 refs, 17 figs, 2 tabs.

8073 (INDC(CCP)–342/L) **The spectra of neutrons from the n+^{209}Bi reaction at 14 MeV.** Devkin, B.V.; Zhuravlev, B.V.; Kobozev, M.G.; Lunev, V.P.; Lychagin, A.A.; Simakov, S.P.; Talalaev, V.A.; Titarenko, N.N. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Nov 1991. 10p. Translation of a paper published in Yadernye Konstanty (Nuclear Constants 2, 1989) - Original report in Russian was distributed as INDC(CCP)-303/G. Translated by the IAEA. Order Number DE92615326. Source: OSTI; NTIS (US Sales Only); INIS.

Experimental data and theoretical interpretation of the spectra of secondary neutrons generated after the interaction of 14 MeV neutrons with ^{209}Bi are presented. 21 refs, 3 figs, 1 tab.

8074 (INDC(CPR)–023/L) **Evaluation of neutron nuclear data of Np-237 for CENDL-2.** Tang Guoyou (Beijing Univ., BJ (China). Inst. of Heavy Ion Physics); Fan Jihong; Cao Wentian; Bao Shanglian; Cai Chonghai. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Oct 1991. 11p. Order Number DE92615327. Source: OSTI; NTIS (US Sales Only); INIS.

The measured data for the (n,f) and (n,gamma) reactions for Np-237 have been evaluated in the energy region from 30 KeV to 20 MeV. All the data of Np-237 for other reaction channels were theoretically calculated. The total cross section, absorption cross section and elastic angular distribution were calculated using the parameters obtained from Optical Model. All data were calculated using general computer code FUP1 (the parameters of the Optical model used as input data to FUP1). The recommended experimental data and the theoretically calculated data were adjusted and let $\sigma_{tot}=\sigma_{el}+\sigma_{non}$. The resonance parameters in the energy range below 30 KeV were also added. All the data in the energy range 10^{-5} eV to 20 MeV were recommended as the data file of Np-237 for CENDL-2. (author). 38 refs, 5 figs, 3 tabs.

8075 (INDC(CPR)–024/L) **Evaluation of cross-sections for dosimetry reactions: Final report to the IAEA for the contract 5516, 1989-1991.** Cai Dunjiu (Chinese Nuclear Data Center, Beijing, BJ (China)). International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Oct 1991. 67p. Order Number DE92615328. Source: OSTI; NTIS (US Sales Only); INIS.

The document summarizes the results of a two-year contract work which was initiated by the IAEA with the Chinese Nuclear Data Centre (CNDC). Cross sections for 15 dosimetry reactions have been evaluated using original systematics and codes developed at the CNDC, some of their own experimental data and the latest experimental data from other sources. The document contains 16 independent papers and a separate abstract was prepared for each of these papers. Refs, figs and tabs.

8076 (INDC(CPR)–024/L, pp. 7-11) **The evaluation of ^{23}Na(n,γ)^{24}Na reaction cross section.** Yuan Hanrong (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy). International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Oct 1991. In *Evaluation of cross-sections for dosimetry reactions: Final report to the IAEA for the contract 5516, 1989-1991.* 67p. Order Number DE92615328. Source: OSTI; NTIS (US Sales Only); INIS.

An evaluation of neutron capture cross section of ^{23}Na is performed based on ENDF/B-VI file. 51 refs, 2 figs, 3 tabs.

8077 (INDC(CPR)–024/L, pp. 12-13) **Evaluation of capture cross section for ^{45}Sc.** Zhao Zhixiang (Chinese Nuclear Data Center, Beijing, BJ (China)). International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Oct 1991. In *Evaluation of cross-sections for dosimetry reactions: Final report to the IAEA for the contract 5516, 1989-1991.* 67p. Order Number DE92615328. Source: OSTI; NTIS (US Sales Only); INIS.

The neutron capture cross section of ^{45}Sc was evaluated based on evaluated resonance parameters, smooth cross sections and systematics of the excitation function for (n,γ) reaction. 13 refs, 1 fig., 1 tab.

8078 (INDC(CPR)–024/L, pp. 14-16) **Evaluation of ^{46}Ti(n,p) ^{46}Sc reaction cross section.** Yu Baosheng (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy); Cai Dunjiu; Lu Hanlin; Zhao Wenrong. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Oct 1991. In *Evaluation of cross-sections for dosimetry reactions: Final report to the IAEA for the contract 5516, 1989-1991.* 67p. Order Number DE92615328. Source: OSTI; NTIS (US Sales Only); INIS.

A reevaluation of the cross section of the reaction ^{46}Ti(n,p) ^{46}Sc is performed based on recent accurate experimental data above 14 MeV. 18 refs, 1 fig., 2 tabs.

8079 (INDC(CPR)–024/L, pp. 16-18) **Evaluation of the ^{N}Ti(n,x) ^{46}Sc reaction cross section.** Yu Baosheng (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy); Cai Dunjiu; Lu Hanlin; Zhao Wenrong. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Oct 1991. In *Evaluation of cross-sections for dosimetry reactions: Final report to the IAEA for the contract 5516, 1989-1991.* 67p. Order Number DE92615328. Source: OSTI; NTIS (US Sales Only); INIS.

In the present evaluation, the cross sections of ^{N}Ti(n,x) ^{46}Sc reaction represent the ^{46}Ti(n,p) cross section plus an additional component produced from ^{47}Ti(n,np) and ^{47}Ti(n,d) reactions. 15 refs, 1 fig., 2 tabs.

8080 (INDC(CPR)–024/L, pp. 19-23) **Evaluation of the ^{48}Ti(n,p) ^{48}Sc reaction cross section.** Yu Baosheng (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy); Cai Dunjiu; Lu Hanlin; Zhao Wenrong. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Oct 1991. In *Evaluation of cross-sections for dosimetry reactions: Final report to the IAEA for the contract 5516, 1989-1991.* 67p. Order Number DE92615328. Source: OSTI; NTIS (US Sales Only); INIS.

The reevaluation of the ^{48}Ti(n,p) ^{48}Sc reaction cross section is performed based on 34 experimental data sets corresponding to 131 experimental points in neutron energy range 5-19 MeV. 41 refs, 2 figs, 3 tabs.

8081 (INDC(CPR)–024/L, pp. 24-28) **Evaluation of the ^{55}Mn(n,2n) ^{54}Mn reaction cross section.** Lu Hanlin (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy); Zhao Wenrong; Yu Weixiang; Cai Dunjiu; Wang Zisheng; Huang Xiaolong. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Oct 1991. In *Evaluation of cross-sections for dosimetry reactions: Final report to the IAEA for the contract 5516, 1989-1991.* 67p. Order Number DE92615328. Source: OSTI; NTIS (US Sales Only); INIS.

The cross section of the reaction ^{55}Mn(n,2n) ^{54}Mn for neutron energies between 10 and 20 MeV was evaluated based on data compiled from literature. A set of recommended cross sections values are given with 0.1 MeV or 0.2 MeV energy steps from 10.5 MeV to 20 MeV. The estimated accuracy is about 2%-15%. 26 refs, 2 figs, 3 tabs.

8082 (INDC(CPR)–024/L, pp. 29-33) **Evaluation of the ^{54}Fe(n,α) ^{51}Cr reaction cross section.** Lu Hanlin (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy); Zhao Wenrong; Yu Weixiang; Cai Dunjiu; Wang Zisheng; Huang Xiaolong. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Oct 1991. In *Evaluation of cross-sections for dosimetry reactions: Final report to the IAEA for the contract 5516, 1989-1991.* 67p. Order Number DE92615328. Source: OSTI; NTIS (US Sales Only); INIS.

The excitation curve for the reaction ^{56}Fe(n,α) ^{51}Cr has been evaluated based on seventeen experimental data sets. The recommended cross sections are given with 0.1, 0.2 or 0.5 MeV energy steps from 4.0 to 20.0 MeV. The estimated accuracy is 30% near threshold, 4-6% below 14 MeV, 2.6% between 14-15 MeV, 3-4% above 15 MeV and 10% up to 20 MeV. 19 refs, 2 figs, 3 tabs.

8083 (INDC(CPR)–024/L, pp. 34-36) **Evaluation of ^{58}Fe(n,γ) ^{59}Fe reaction cross sections and its covariance.** Zhao Zhixiang (Chinese Nuclear Data Center, Beijing, BJ (China)); Liu Tong. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Oct 1991. In *Evaluation of cross-sections for dosimetry reactions: Final report to the IAEA for the contract 5516, 1989-1991.* 67p. Order Number DE92615328. Source: OSTI; NTIS (US Sales Only); INIS.

The evaluations for ^{58}Fe(n,γ) ^{59}Fe reaction cross sections and its covariance data are completed and compared with ENDF/B-V. (author). 24 refs, 1 fig., 3 tabs.

8084 (INDC(CPR)–024/L, pp. 37-38) **The evaluation of ^{59}Co(n,γ)^{60}Co reaction cross section and its covariance data.** Liu Tong (Chinese Nuclear Data Center, Beijing, BJ (China)); Zhou Delin. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Oct 1991. In *Evaluation of cross-sections for dosimetry reactions: Final report to the IAEA for the contract 5516, 1989-1991.* 67p. Order Number DE92615328. Source: OSTI; NTIS (US Sales Only); INIS.

The cross section of the reaction ^{59}Co(n,γ)^{60}Co has been evaluated based on the data from the ENDF/B-V file. 6 refs, 1 fig., 2 tabs.

8085 (INDC(CPR)–024/L, pp. 39-47) **Evaluation of the Co^{59}(n,2n)Co^{58,58m} reaction cross section.** Cai Dunjiu (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy); Wang Zisheng; Yu Baosheng; Lu Hanlin; Zhao Wenrong. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Oct 1991. In *Evaluation of cross-sections for dosimetry reactions: Final report to the IAEA for the contract 5516, 1989-1991.* 67p. Order Number DE92615328. Source: OSTI; NTIS (US Sales Only); INIS.

The cross section of the reaction ^{59}Co(n,2n)$^{58.58m}$Co at 14.7 MeV and for neutron energies from threshold to 25 MeV has been evaluated based on recent experimental data. 41 refs, 3 figs, 5 tabs.

8086 (INDC(CPR)–024/L, pp. 48-50) **Evaluation of ^{59}Co(n,α)^{56}Mn reaction.** Zhao Wenrong (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy); Lu Hanlin; Yu Weixiang; Cai Dunjiu; Wang Zisheng; Huang Xiaolong. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Oct 1991. In *Evaluation of cross-sections for dosimetry reactions: Final report to the IAEA for the contract 5516, 1989-1991.* 67p. Order Number DE92615328. Source: OSTI; NTIS (US Sales Only); INIS.

The cross section of the reaction ^{59}Co(n,α)^{56}Mn at 14.7 MeV and for neutron energies between 5.0 and 21.0 MeV with a step of 0.2 MeV has been evaluated using recent experimental data. 25 refs, 2 figs, 3 tabs.

8087 (INDC(CPR)–024/L, pp. 51-53) **Evaluation of ^{109}Ag(n,γ)^{110m}Ag reaction cross sections and their covariance data.** Zhao Zhixiang (Chinese Nuclear Data Center, Beijing, BJ (China)). International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Oct 1991. In *Evaluation of cross-sections for dosimetry reactions: Final report to the IAEA for the contract 5516, 1989-1991.* 67p. Order Number DE92615328. Source: OSTI; NTIS (US Sales Only); INIS.

The isomer capture cross sections of ^{109}Ag and their covariance data were evaluated in the energy range from 1.0 E^{-5} eV to 20 MeV based on experimental information including the measured data of total capture cross section, systematics and theoretical calculation. 14 refs, 3 figs, 1 tab.

8088 (INDC(CPR)–024/L, pp. 54-59) **Evaluation of the ^{115}In(n,n') ^{115m}In reaction cross section.** Cai Dunjiu (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy); Yu Baosheng; Lu Hanlin; Zhao Wenrong. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Oct 1991. In *Evaluation of cross-sections for dosimetry reactions: Final report to the IAEA for the contract 5516, 1989-1991.* 67p. Order Number DE92615328. Source: OSTI; NTIS (US Sales Only); INIS.

The cross section of the reaction ^{115}In(n,n') ^{115m}In from threshold (0.399 MeV) to 20 MeV was reevaluated based on recent experimental information. 38 refs, 1 fig., 4 tabs.

8089 (INDC(CPR)–024/L, pp. 60-63) **Evaluation of the ^{115}In(n,2n)^{114m}In reaction cross-section.** Lu Hanlin (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy); Zhao Wenrong. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Oct 1991. In *Evaluation of cross-sections for dosimetry reactions: Final report to the IAEA for the contract 5516, 1989-1991.* 67p. Order Number DE92615328. Source: OSTI; NTIS (US Sales Only); INIS.

The cross section of the reaction ^{115}n(n,2n) ^{114m}In at 14.7 MeV and from threshold to 20 MeV has been evaluated based on recent published experimental data. 28 refs, 2 figs, 3 tabs.

8090 (INDC(CPR)–024/L, pp. 64-67) **The evaluation of ^{127}I(n,2n)^{126}I reaction.** Zhao Wenrong (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy); Lu Hanlin; Yu Weixiang; Cai Dunjiu; Wang Zisheng; Huang Xiaolong. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Oct 1991. In *Evaluation of cross-sections for dosimetry reactions: Final report to the IAEA for the contract 5516, 1989-1991.* 67p. Order Number DE92615328. Source: OSTI; NTIS (US Sales Only); INIS.

The cross section of the reaction ^{127}I(n,2n) ^{126}I at 14.7 MeV and for neutron energies from threshold to 20 MeV has been evaluated based on recent experimental data. 16 refs, 1 fig., 4 tabs.

8091 (INDC(HUN)–030/L) **Processing of evaluated neutron data files in ENDF format on personal computers.** Vertes, P. (Hungarian Academy of Sciences, Budapest (Hungary). Central Research Inst. for Physics). International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Nov 1991. 13p. Order Number DE92615344. Source: OSTI; NTIS (US Sales Only); INIS.

A computer code package - FDMXPC - has been developed for processing evaluated data files in ENDF format. The earlier version of this package is supplemented with modules performing calculations using Reich-Moore and Adler-Adler resonance parameters. The processing of evaluated neutron data files by personal computers requires special programming considerations outlined in this report. The scope of the FDMXPC program system is demonstrated by means of numerical examples. (author). 5 refs, 4 figs, 4 tabs.

8092 (INIS-mf--13026, pp. 27-28) **Field theoritic study of the properties of ^{4}He: a variational approach.** Panda, P.K. (Institute of physics, Bhubaneswar (India)); Patra, S.K.; Misra, S.P. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123--: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. HELIUM 4 TARGET/heavy ion reactions; BINDING ENERGY; HELIUM 4; MEV RANGE 01-10; MEV RANGE 10-100; PHOTON EMISSION; PIONS; WAVE FUNCTIONS

8093 (INIS-mf--13026, pp. 227-228) **Analysis of particle production in the spallation reaction.** Sinha, Amar (Bhabha Atomic Research Centre, Bombay (India). Neutron Physics Div.); Srinivasan, M. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123--: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CHROMIUM 52 TARGET/particle production; CHROMIUM 52 TARGET/spallation; IRON 56 TARGET/particle production; IRON 56 TARGET/spallation; LEAD 207 TARGET/spallation; SPALLATION/particle production; SPALLATION/proton reactions; SPALLATION; CROSS SECTIONS; EVAPORATION MODEL; HELIUM 3; HELIUM 4; MESONS; MEV RANGE 10-100; MEV RANGE 100-1000; NEUTRONS; NUCLEAR CASCADES; NUCLEAR REACTION YIELD; PROTONS

8094 (INIS-mf--13026, pp. 247-248) **Multifragmentation versus liquid-gas phase transition in nuclear systems.** Das, A. (Institute of Physics, Bhubaneswar (India)); Mishra, M.; Satpathy, L.; Satpathy, M. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123--: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

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8095 (INIS-mf--13026, pp. 213-214) **Simple formula of heavy-ion potential with spin-density term in energy density formalism : s-d and fsub(7/2) shell nuclei.** Puri, R.K. (Panjab Univ., Chandigarh (India). Dept. of Physics); Gupta, R.K. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123--: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ARGON 34/energy density; ARGON 34/spin; NICKEL 56/energy density; NICKEL 56/spin; SPIN; CROSS SECTIONS; MEV RANGE 01-10; SKYRME POTENTIAL

8096 (INIS-mf--13026, pp. 215-216) **Alpha-clustering transfer effects in colliding s-d shell nuclei.** Puri, R.K. (Panjab Univ., Chandigarh (India). Dept. of Physics); Gupta, R.K. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123--: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CALCIUM 40 TARGET/alpha-transfer reactions; NICKEL 56/alpha-transfer reactions; OXYGEN 16 REACTIONS/alpha-transfer reactions; ENERGY DENSITY; MASS NUMBER; MEV RANGE 10-100; NICKEL 58; NICKEL 60; NUCLEAR FRAGMENTATION; NUCLEAR POTENTIAL; NUCLEAR REACTION YIELD; SCHROEDINGER EQUATION

8097 (INIS-mf--13026, pp. 217-218) **Fusion limited by temperature.** Bandyopadhyay, D. (Saha Inst. of Nuclear Physics, Calcutta (India)); Samaddar, S.K.; De, J.N. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123--: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CALCIUM 40 TARGET/cross sections; CALCIUM 40 TARGET/heavy ion fusion reactions; HEAVY ION FUSION REACTIONS/cross sections; HEAVY ION FUSION REACTIONS/energy dependence; CALCIUM 40 REACTIONS; EMISSION; ENERGY DENSITY; MEV RANGE 10-100

8098 (INIS-mf--13026, pp. 219-220) **A simple two-channel barrier penetration model of heavy ion fusion.** Ahmed, Zafar (Bhabha Atomic Research Centre, Bombay (India). Nuclear Physics Div.). Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123--: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. 10 refs. HEAVY ION FUSION REACTIONS/energy dependence; LEAD 208 TARGET/heavy ion fusion reactions; NICKEL 58 TARGET/heavy ion fusion reactions; NICKEL 64 TARGET/heavy ion fusion reactions; TIN 122 TARGET/heavy ion fusion reactions; ARGON 40 REACTIONS; COULOMB FIELD; MEV RANGE 10-100; MEV RANGE 100-1000; NICKEL 58 REACTIONS; NUCLEAR MODELS; NUCLEAR STRUCTURE; OXYGEN 16 REACTIONS

8099 (INIS-mf--13026, pp. 267-268) **A study of collective flow of nuclear matter in La+Ag(Br) reaction.** Palsania, H.S. (Rajasthan Univ., Jaipur (India). Dept. of Physics); Singh, B.; Gill, A.; Kumar, V.; Bhalla, K.B.; Lokanathan, S. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123--: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. LANTHANUM 139 REACTIONS/nuclear fragments; ALPHA PARTICLES; BROMINE; GEV RANGE 01-10; MULTIPLICITY; NUCLEAR EMULSIONS; NUCLEAR MATTER; SILVER; TARGETS

8100 (INIS-mf--13026, pp. 271-272) **Forward-transverse energy correlations in ultra-relativistic heavy ion collisions.** Gupta, S.K. (Bhabha Atomic Research Centre, Bombay (India). Nuclear Physics Div.); Das, Swapan. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123--: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. SILICON 28 REACTIONS/energy; SULFUR 32 REACTIONS/energy; ALUMINIUM; COPPER; GEV RANGE 01-10; GEV RANGE 100-1000; GOLD; NUCLEONS; PROJECTILES; RELATIVISTIC RANGE; ENERGY; SILVER; SULFUR; TARGETS

8101 (INIS-mf--13026, pp. 273-274) **Energy distribution of muon pairs and photon pairs in relativistic heavy ion collisions.** Janhavi, G. (Madras Univ. (India). Dept. of Nuclear Physics); Subramanian, P.R. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123--: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium* *on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. HEAVY ION REACTIONS/muon pairs; HEAVY ION REACTIONS/photons; MUON PAIRS/heavy ion reactions; PHOTONS/heavy ion reactions; QUARK MATTER/heavy ion reactions; BARYONS; ENERGY DENSITY; ENERGY SPECTRA; ENTROPY; EQUATIONS OF STATE; GEV RANGE 01-10; PHOTONS; HYDRODYNAMIC MODEL; PAIR PRODUCTION; PHASE TRANSFORMATIONS; RELATIVISTIC RANGE

8102 (INIS-mf–13026, pp. 287-288) **Forward energy flow cross-section in ultra-relativistic heavy-ion collisions.** Das, Swapan (Bhabha Atomic Research Centre, Bombay (India). Nuclear Physics Div.); Gupta, S.K. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ALUMINIUM/silicon 28 reactions; GOLD/silicon 28 reactions; ALUMINIUM; CROSS SECTIONS; GEV RANGE 10-100; GOLD; RELATIVISTIC RANGE; TARGETS

8103 (INIS-mf–13026, pp. 279-280) **On the relativistic nuclear reactions and quark-antiquark recombination model.** Sharma, A.P. (Aligarh Muslim Univ. (India). Dept. of Physics). Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. PION MINUS REACTIONS/quark-antiquark interactions; PION MINUS REACTIONS/relativistic range; CYANATES; GEV RANGE 10-100; MAGNETIC FIELDS; PEAKS; PIONS MINUS; PIONS PLUS; QUARKS; SILVER BROMIDES

8104 (INIS-mf–13026, pp. 211-212) **Important aspects of fragment angular momentum in medium energy fission.** Naik, H. (Bhabha Atomic Research Centre, Bombay (India). Radiochemistry Div.); Datta, T.; Dange, S.P.; Patra, C.N.; Satya Prakash. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. FISSION/energy dependence; FISSION FRAGMENTS/angular momentum; PLUTONIUM 241 TARGET/fission yield; URANIUM 238 TARGET/fission yield; ALPHA REACTIONS; COMPOUND NUCLEI; FISSION; IODINE 132; IODINE 134; ISOMERIC NUCLEI; MEV RANGE 01-10; MEV RANGE 10-100; NEUTRON REACTIONS; SPHERICAL MODEL

8105 (INIS-mf–13026, pp. 225-226) **Binary fission of highly excited nuclei.** Goswami, K. (Goalpara Coll. (India). Dept. of Physics); Goswami, T.D. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. BROMINE/binary fission; BROMINE/nuclear decay; SILVER/binary fission; SILVER/nuclear decay; BROMINE; CROSS SECTIONS; EVAPORATION MODEL; EXCITED STATES; FISSION FRAGMENTS; GEV RANGE 01-10; GEV RANGE 10-100; KAON MINUS REACTIONS; NUCLEAR EMULSIONS; PROTON REACTIONS; SILVER

8106 (INIS-mf–13026, pp. 289-290) **Fission in q-nucleus.** Pati, A.K. (Bhabha Atomic Research Centre, Bombay (India). Theoretical Physics Div.). Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. NUCLEAR STRUCTURE/quarks; URANIUM 235/quarks; COULOMB ENERGY; FISSION; MASS FORMULAE; MASS NUMBER; QUARKS; WEIZSAECKER FORMULA

8107 (INIS-mf–13026, pp. 221-222) **Data analysis of ^{64}Zn(20.1MeV/u)+^{9}Be reaction.** Anon. VECC-RIKEN Collaboration. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. BERYLLIUM 9 TARGET/zinc 64 reactions; ARSENIC 65; GALLIUM 61; ISOTOPE RATIO; MEV RANGE 10-100; TIME-OF-FLIGHT METHOD

8108 (INIS-mf–13078) **A theory of low energy π-^{3}He elastic scattering.** Geffen, F.M.M. van. Vrije Univ., Amsterdam (Netherlands). 14 Mar 1991 95p. Order Number DE92614376. Source: OSTI; NTIS (US Sales Only); INIS.

Includes summary in Dutch.

The main aim of this work is the construction of a first-order optical potential for the scattering of pions by ^{3}He at low energy with as few approximations as possible. In particular the Fermi motion is treated extremely carefully by using microscopic ^{3}He wave functions and by performing the complete Fermi-integral. Differential cross-sections and analyzing powers have been calculated. In a detailed comparison between the first-order optical with one which results from using the semi-factored approximation, it became clear that the latter has the following shortcomings: 1. the dependence of the subenergy on the pion-nucleus scattering angle, and 2. the independence of this energy on the relative motion of the spectator nucleons. (author). 101 refs.; 15 figs.; 3 tabs.

8109 (JINR-R–7-90-112) **On the detection of spontaneous fission of nuclei implanted into a Si(Au) surface-barrier detector.** Tsyganov, Yu.S.; Rim Yun Sen. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions. 1990. 6p. (In Russian). Order Number DE92609913. Source: OSTI; NTIS (US Sales Only); INIS.

Spontaneous fission of nuclei implanted into a silicon surface-barrier detector has been investigated. A single parameter model of electron-hole plasma has been designed. The value of this parameter may be determined through an independent experiment. A systematics for first approximations of the total kinetic energy has been suggested. The result of calculations have been compared with the available data on the decay of ^{252} 102 nuclei. 10 refs.; 4 figs.

8110 (Juel–2449) **Compton scattering on hadronic systems.** Baron, N.C. Forschungszentrum Juelich GmbH (Germany). Inst. fuer Kernphysik. Feb 1991. 180p. (In German). Order Number DE92758895. Source: OSTI; NTIS (US Sales Only); INIS.

Compton scattering with real photons is studied for several hadronic systems, where special care is taken of the internal structure of the systems. The scattering on the deuteron is treated in terms of an analytically solvable model in the low energy region as in illustration for the general theory of low energy Compton scattering. For the ^{208}Pb target nucleus a consistent treatment of the retardation leads to an interpretation of scattering data below and above the giant resonances up to energies of 50 MeV. Compton scattering in the Δ-resonance region is studied for the nucleon. The internal structure is described via a constituent quark model resulting in a proper treatment of the polarizabilities of the nucleon. The effect of binding on the polarizabilities is discussed on the basis of kinematical effects and modifictions due to the retardation. (orig.).

8111 (Juel–2477) **Hadronic spin excitations in finite fermion systems.** Unkelbach, W. Forschungszentrum Juelich GmbH (Germany). Inst. fuer Kernphysik; Bonn Univ. (Germany). May 1991. 152p. (In German). Order Number DE92758896. Source: OSTI; NTIS (US Sales Only); INIS.

Hadronic spin-excitations in finite Fermi systems are investigated by studying inelastic proton- and antiproton-nucleus scattering in doubly magic nuclei (^{12}C, 4^{0}Ca, ^{48}Ca, ^{208}Pb). The Random-Phase-Approximation (RPA) and the Distorted-Wave-Born-Approximation

(DWBA) are used to describe the nuclear structure and reaction respectively. The possibility of a low-energy octupole resonance (LEOR) in ^{208}Pb, which exhausts a significant fraction of the energy weighted sum rule, is investigated. It is found that the sum-rule fraction of $\propto$ 15% seen in (p,p') reactions depends sensitively on the strength of the isovector projectile-target nucleus interaction. To study spin-excitations in (p,p')-reactions, the double differential cross section and the spin-flip probability S_{yy} are calculated for forward angles. They are in good agreement with experiments on ^{40}Ca, ^{48}Ca and ^{208}Pb at intermediate incident energies (200 MeV - 800 MeV). The experimentally observed spin-dipole resonance in ^{40}Ca can be reproduced. S_{yy} depends sensitively on the distorions of the projectile wave. Different versions of the Nanti N-potential of the Bonn-Juelich group have been used to calculate (anti p,anti p') cross sections on ^{12}C. They show large sensitivity for unnatural parity states. Because of the strong absorption, this reaction is an excellent probe for the long-range one-pion exchange. (orig.).

8112 (KURRI-TR–345, pp. 66-69) **On bimodal fission of light actinide nuclei.** Nakahara, Hiromichi (Tokyo Metropolitan Univ. (Japan)). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Mar 1991. (In Japanese). (CONF-9008225–: Specialists' meeting on physics and engineering of fission and spallation; Specialists' meeting on physics and engineering of fission and spallation, Kumatori (Japan); Kumatori (Japan), 2 Aug 1990; 10 jan 1991; CONF-9101117–). In *Proceedings of the specialists' meeting on physics and engineering of fission and spallation, 1990.* 118p. Order Number DE92713857. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. FISSION PRODUCTS/proton reactions; FISSION PRODUCTS/thorium 232 target; MEV RANGE 10-100; FISSION YIELD; MASS NUMBER; NUCLEAR DEFORMATION; EXPERIMENTAL DATA

8113 (KURRI-TR–345, pp. 70-80) **Statistical analysis on fusion fission phenomena of light compound nucleus formed by low energy heavy ion reaction.** Matsuse, T. (Shinshu Univ., Ueda, Nagano (Japan). Faculty of Textile Science and Technology); Lee, S.M.; Beck, C. Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Mar 1991. (CONF-9008225–: Specialists' meeting on physics and engineering of fission and spallation; Specialists' meeting on physics and engineering of fission and spallation, Kumatori (Japan); Kumatori (Japan), 2 Aug 1990; 10 jan 1991; CONF-9101117–). In *Proceedings of the specialists' meeting on physics and engineering of fission and spallation, 1990.* 118p. Order Number DE92713857. Source: OSTI; NTIS (US Sales Only); INIS.

Heavy fragment productions from light compound nucleus (A < 60) induced by low energy heavy-ion reaction are analyzed in terms of Extended Hauser Feshbach (EHF) method. This EHF method should be considered to attempt for treating light-particle emission and heavy fragment production in the equivalent statistical way. The mass-, charge- and kinetic energy- distributions of ^{35}Cl + ^{12}C reaction (E_{Lab} = 180,200 MeV) and ^{32}S + ^{24}Mg reaction (E_{Lab} = 142 MeV) are extensively investigated as the typical examples. First of all, it is shown that the variations in observed cross section from fragment to fragment are completely coincide with the variation of binding energy of the lighter fragments. Therefore the nascent fragment from the compound nucleus around the scission point are expected to have the almost same properties of the individual nucleus. Because the variation of the binding energy are understood as the shell correction energy, the temperature dependent level density parameter a(T) evaluated by the use of the observed shell structure energy is applied to the level density of the heavier part of fragment and also the nuclei of evaporation residues. The calculated phase space of light-particle emission are improved, then the observed yields of the heavy fragments of both ^{35}Cl + ^{12}C and ^{32}S + ^{24}Mg are well reproduced by the same parameter set in EHF calculation. The calculated kinetic energy distribution are transformed in the standard way to the distribution in the laboratory system and shown to reproduce well the measured kinetic energy distribution. Therefore the observed heavy fragment production are understood as the statistical binary decay from the compound nucleus induced by heavy-ion reaction. (author).

8114 (KURRI-TR–345, pp. 96-100) **Pion induced reactions in ^{9}Be, ^{12}C and ^{19}F.** Imanishi, Nobutsugu (Kyoto Univ. (Japan). Faculty of Engineering). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Mar 1991. (In Japanese). (CONF-9008225–: Specialists' meeting on physics and engineering of fission and spallation; Specialists' meeting on physics and engineering of fission and spallation, Kumatori (Japan); Kumatori (Japan), 2 Aug 1990; 10 jan 1991; CONF-9101117–). In *Proceedings of the specialists' meeting on physics and engineering of fission and spallation, 1990.* 118p. Order Number DE92713857. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. PION MINUS REACTIONS/delta baryons; PION PLUS REACTIONS/delta baryons; GEV RANGE 01-10; MEV RANGE 100-1000; CROSS SECTIONS; EXCITATION FUNCTIONS; BERYLLIUM 9 TARGET; FLUORINE 19 TARGET; CARBON 13 TARGET; EXPERIMENTAL DATA; CARBON 12 TARGET

8115 (KURRI-TR–345, pp. 42-47) **Nuclear reaction cross sections with high energy neutrons.** Nakamura, Takashi (Tohoku Univ., Sendai (Japan). Cyclotron and Radioisotope Center). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Mar 1991. (In Japanese). (CONF-9008225–: Specialists' meeting on physics and engineering of fission and spallation; Specialists' meeting on physics and engineering of fission and spallation, Kumatori (Japan); Kumatori (Japan), 2 Aug 1990; 10 jan 1991; CONF-9101117–). In *Proceedings of the specialists' meeting on physics and engineering of fission and spallation, 1990.* 118p. Order Number DE92713857. Source: OSTI; NTIS (US Sales Only); INIS.

As for the nuclear reaction cross sections with neutrons, in the energy range below 20 MeV, there are many measured data, and the theoretical calculation based on the experimental data has been carried out, consequently, the evaluated data files, ENDF/B-5, JENDL-3 and so on, have been provided. However in the energy range exceeding 20 MeV, there scarcely is monochromatic neutron field in the world, accordingly the experimental data scarcely exist. Recently for the research on the damage of fusion reactor materials and others, the data on the radioactivation cross sections of 15-50 MeV have become necessary, and with the wide utilization of accelerators, the induced radioactivity of equipment has become a problem. However, the experimental data for higher than 20 MeV are still very few at present. In this paper, the outline of the radioactivation cross sections measured by using the quasi-monochromatic neutron beam by Be-9 (p,n) reaction is reported. As for the method of measurement, proton beam was extracted from a cyclotron, and irradiated on the Be targets. The generated monochromatic neutrons were measured with a scintillator. (K.I.).

8116 (LA–12209-T) **Pion double charge exchange above the Δ3/2,3/2 resonance.** Williams, A.L. Los Alamos National Lab., NM (United States). Nov 1991. 104p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. Order Number DE92003621. Source: OSTI; NTIS; INIS; GPO Dep.

Thesis submitted to University of Texas at Austin.

The first exclusive measurements of $(\pi^+\pi^-)$ reactions on several nuclei for incident pion energies from 300 to 550 MeV are reported. The measurements were made with the Large Acceptance Spectrometer at the P^3 channel of the Clinton P. Anderson Meson Physics Facility. A description of the experimental setup is given which includes a discussion of modifications to the spectrometer and channel implemented specifically for these measurements. Forward angle excitation functions for transitions to the double isobaric analog state (DIAS) are found to be relatively flat for these energies. This energy dependence is reproduced by optical and Glauber calculations, but not by a six-quark bag prediction. The mass dependence of the DIAS was found to qualitatively agree with the predicted mass dependence from optical calculations. One angular distribution was measured for $5° \leq \Theta_{lab} \leq 35°$ for $^{18}O(\pi^+\pi^-)^{18}Ne$. The DIAS cross section falls by more than one order of magnitude over this range, as predicted by both Glauber and optical model calculations. Data for $f_{7/2}$-shell nuclei were examined with a two-amplitude model based on seniority-zero shell model wavefunctions which features expressions for cross sections for DIAS transitions and transitions to nonanalog ground-states. The cross sections for T = 1 nuclei are found to be inconsistent with the predictions of the model. One excitation function for nonanalog transitions was measured and is relatively flat with energy. The continuum of nonanalog states near threshold was found to decrease with energy.

8117 (RCNP-P–114) **Proceedings of study meeting on microscopic and phenomenological research of interaction for light heavy-ion systems.** Osaka Univ., Ibaraki (Japan). Research Center for Nuclear Physics. Jun 1991. 146p. Order Number DE92751063. Source: OSTI; NTIS (US Sales Only); INIS.

The Research Center for Nuclear Physics study meeting 'Microscopic and phenomenological research of interaction for light heavy-ion systems was held on March 7-9, 1990 as the study meeting in the second half of 1990, and 25 researchers took part in it. As the background of holding this study meeting, the fact that recently the rainbow scattering due to nuclear force was discovered experimentally in ^{16}O-^{16}O system, and phenomenologically it was explained only by deep inter-nucleus potential. This should be evaluated as an important foothold for the research on the interaction for light heavy-ion systems and nuclear reaction mechanism. Accordingly, most of the papers presented this time were those related to the inter-nucleus potential and nuclear reaction mechanism. Also the development of theoretical analysis method was carried out and reported. Further, recently the experimental study on the structure and reaction of the neutron rich nucleus has advanced, and the theoretical research related to this topic was reported. (K.I.).

6635 Nuclear Mass Ranges

Refer also to citation(s) 7935, 7996, 8002, 8038, 8045, 8049, 8050, 8051, 8052, 8061, 8110, 8111, 8112, 8113, 8114, 8117

8118 (IC–91/129) **The (^{3}He, ^{7}Be) reaction on light and medium mass nuclei.** Rahman, M.A. (International Centre for Theoretical Physics, Trieste (Italy)); Lezoch, P.; Trost, H.J.; Strohbusch, U. International Centre for Theoretical Physics, Trieste (Italy). Jun 1991. 26p. Order Number DE92609934. Source: OSTI; NTIS (US Sales Only); INIS.

(^{3}He, ^{7}Be) reaction have been measured and re-analysed on some A = 4n target nuclei between ^{12}C and ^{90}Zr. An exact finite-range DWBA calculations, with spin-orbit term in the optical potentials, have been carried out assuming a single-step alpha-cluster transfer. The question of the observed characteristic difference between two ^{7}Be-states has been discussed in some detail. It is apparent that, despite the deficiencies in the details of the quality of the description to the angular distribution, the spin-orbit term represents the major reason for the characteristic difference between the two ^{7}Be-states. Both absolute and relative alpha-spectroscopic factors are deduced. It is concluded that staying in the same potential family, variations of S_α between ^{12}C and ^{40}Ca are but moderate with possible existence for local variations, S_α being lower in the middle of the sd shell and higher for ^{40}Ca. At relatively higher beam energy, i.e., at 70 MeV in the present case and with increasing mass number, S_α-values, in general decrease, implying a decrease in surface alpha-clustering for heavier nuclei. (author). 30 refs, 11 figs, 3 tabs.

8119 (JINR-E–2-90-20) **Glauber theory of high-energy p-He scattering with composite nucleons.** Omboo, Z.; Bayarsaykhan, Ch.; Ganbold, O.; Tseren, Ch. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems. 1990. 8p. Order Number DE92609745. Source: OSTI; NTIS (US Sales Only); INIS.

The differential cross sections of pa elastic scattering at high energies are calculated in the framework of the multiple scattering theory. By taking explicity into account the composite structure of hadrons and the effects of quark exchange some discrepancies between the theory and the data that were recently pointed out were eliminated. 10 refs.; 1 fig.; 1 tab.

8120 (JINR-R–1-90-149) **Observation of the Coulomb interaction effect in pion pairs from the reaction $p+Ta\rightarrow\pi^++\pi^-+X$ at proton energy 70 GeV.** Afanas'ev, L.G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems); Karpukhin, V.V.; Gorchakov, O.E. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems. 1990. 28p. (In Russian). Order Number DE92609956. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Yad. Fiz.

Pion pair production from the reaction $p+Ta\rightarrow\pi^++\pi^-+X$ at proton energy 70 GeV has been studied. Pions in the 0.8-2.4 GeV/c momentum range have been detected at an angle of 8.4^0 to the proton beam, in acceptance angle of 3.8 sr. Pion pair correlations as a function of the relative momentum q in a $\pi^+\pi^-$-pair C.M.S. have been measured at the unstudied before region of $q<40$ MeV/c. The correlation function is observed sharply increasing at q reduction smaller than 10 MeV/c. The experimental data agree with the calculation that takes into account the Coulomb factor in the differential cross section of pion pairs production. 28 refs.; 11 figs.

8121 (JINR-R–1-90-198) **Estimation of the EMC-effect value in the deuteron.** Lednicky, R.; Peshekhonov, D.V.; Smirnov, G.I. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy. 1990. 6p. (In Russian). Order Number DE92609733. Source: OSTI; NTIS (US Sales Only); INIS.

Submitted to Yad. Fiz.

An analysis of μ, ν and ν-bar scattering on hydrogen and deuterium targets within the framework of the quark-parton model have been performed. The results indicate that the distortion of the structure functions of free neutrons and protons in the deuterium nucleus is small. 10 refs.; 1 fig.; 1 tab.

6636 Radiation Physics

Refer also to citation(s) 7029, 8336

8122 (CONF-920308–2) **A nodal integral method for neutron diffusion in hexagonal geometry.** Azmy, Y.Y. Oak Ridge National Lab., TN (United States). [1991]. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Advances in reactor physics; Charleston, SC (United States); 8-11 Mar 1992. Order Number DE91015925. Source: OSTI; NTIS; GPO Dep.

We derive a new nodal method for the neutron diffusion equation using the Nodal Integral Method (NIM) formalism. The new approach is based on a coordinate transformation, reminiscent of that used in boundary fitted coordinates methods, to transform a general parallelogram into a rectangle. The transformed equation in this case contains a mixed derivative, in addition to the standard diffusion operator. We then apply the NIM formalism to the transformed equation and derive the discrete-variable balance equation and current continuity conditions. Finally, we transform the resulting expressions back into the original coordinate system, and manipulate them to obtain a single balance equation for the entire hexagon. 5 refs., 2 figs.

8123 (DOE/OR/00033–T462) **Labor market trends for health physicists.** Oak Ridge Associated Universities, Inc., TN (United States). Nov 1991. 18p. Sponsored by U.S. DOE Energy Research; Nuclear Regulatory Commission. DOE Contract AC05-76OR00033. Order Number DE92004770. Source: OSTI; NTIS; GPO Dep.

Information is presented on the recent trends in enrollments, degrees and US civilian, non-medical employment for health physicists. This information is combined with other data such as salary comparisons, indicators of hiring difficulties by the federal government, and information received from employers to assess the current labor market status for health physicists. This information indicates that for the last several years demands for new graduate health physicists have been greater than supplies. An assessment of projected enrollment and degree trends and employment trends through the mid-1990s is presented. This assessment indicates that the current labor market situation is not likely to change – the number of job openings will continue to exceed the number of new graduates available for employment. Moreover, information is presented which indicates that there are several factors at work in the general economy which will make is difficult to enhance health physics enrollments and degrees. Thus, while the recent increase in enrollments in health physics programs and the addition of two new programs in 1990 is encouraging, these are not enough to meet future employment needs. Employers will, in all likelihood, continue to have difficulties in hiring health physicists, and salaries will continue to be relatively high through the mid-1990s. 16 refs., 8 figs.

8124 (INIS-mf–13026, pp. 331-332) **Empirical range-energy relation for electrons of energy less than 10 KeV.** Agrawal, S.M. (S.V. College, Aligarh (India) Dept. of Physics); Pal, P.B.; Varshney, V.P. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. ELECTRONS/energy losses; ARGON; ELASTIC SCATTERING; ELECTRONS; EV RANGE 100-1000; HELIUM; INELASTIC SCATTERING; KEV RANGE 01-10; KRYPTON; NEON; RANGE; THEORETICAL DATA; XENON

8125 (INIS-mf–13026, pp. 333-334) **Total stopping power in low energy electrons.** Agrawal, M. (S.V. College, Aligarh (India). Dept. of Physics); Pal, P.B.; Gupta, D.K.; Varshney, V.P. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. 12 refs. ALUMINIUM/stopping power; CARBON/stopping power; COPPER/stopping power; ELECTRONS/energy losses; SILVER/stopping power; URANIUM/stopping power; ABSORPTION; ALUMINIUM; CARBON; COPPER; ELECTRONS; KEV RANGE 01-10; KEV RANGE 100-1000; KINETIC ENERGY; LEAST SQUARE FIT; RANGE; SILVER; URANIUM

8126 (INIS-mf–13026, pp. 335-336) **Stopping power relation for low energy positrons.** Agrawal, M. (S.V. College, Aligarh (India). Dept. of Physics); Pal, P.B.; Gupta, D.K.; Varshney, V.P. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. 13 refs. ALUMINIUM/stopping power; CARBON/stopping power; COPPER/stopping power; POSITRONS/absorption; POSITRONS/stopping power; ALUMINIUM; CARBON; COPPER; ENERGY LOSSES; KEV RANGE 01-10; KEV RANGE 10-100; KEV RANGE 100-1000; KINETIC ENERGY; LEAST SQUARE FIT; POSITRONS; ABSORPTION

8127 (INIS-SU–290, pp. 85) **Propagation of fast electrons in matter.** Entizov, I.Z. (AN Ukrainskoj SSR, Kiev (Ukrainian SSR)); Isarova, E.V. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. 1 ref. ELECTRONS/charged-particle transport; ABSORPTION; ALUMINIUM; ELECTRONS; ENERGY SPECTRA; KEV RANGE 100-1000; MEV RANGE 01-10

8128 (Juel–2435) **The preparation of computer-supported methods for the analysis of radiation situation at particle accelerators and their exemplary application to the cooler synchrotron COSY.** Moll, J. Forschungszentrum Juelich GmbH (Germany). Inst. fuer Kernphysik; Wuppertal Univ. (Gesamthochschule) (Germany). Jan 1991. 108p. (In German). Order Number DE92758892. Source: OSTI; NTIS (US Sales Only); INIS.

In this thesis the applicability of modern particle transport programs for the radiation protection of the new cooler synchrotron COSY has been investigated. Monte Carlo codes as the program system HERMES offer a large flexibility in geometry simulation and a wide spread applicability up to the GeV energy region because of its implemented physical models. These codes are very suitable for detailed analysis of radiation sources within the accelerator and for dose rate estimations behind radiation shields. Detailed calculations of double differentional flux spectra and surface dose rate distributions at a cylindrical standard target for different materials (iron, copper and lead) were done for 2.5GeV protons incident. In case of deep penetration problems it turns out, that the CPU-time requirement of the Monte Carlo codes increases rapidely. Therefore the Monte Carlo codes were coupled with a one-dimentional S_n transport code to treat deep penetration problems in a reasonable computer CPU-time. For this purpose a new high energy neutron-γ transport library was evaluated taking into account the upper energy limit of COSY with 2.8GeV. The needed cross sections have been calculated by using the physical models of one of the HERMES-codes. Several Fortran-routines were developed to get an automatically procedure, which is used to evaluate the results and determine Legendre polynominals of order P3, which had to be inserted as coefficients into the library. The coupling procedure between the programs has been automated by means of several Fortran-routines, which does transformation, normalisation and formatting of the flux-data. (orig./HST).

8129 (KAPL–4731) **A variable timestep generalized Runge-Kutta method for the numerical integration of the space-time diffusion equations.** Aviles, B.N.; Sutton, T.M.; Kelly, D.J. III. Knolls Atomic Power Lab., Schenectady, NY (United States). Sep 1991. 15p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC12-76SN00052. (CONF-920308–4: Advances in reactor physics, Charleston, SC (United States), 8-11 Mar 1992). Order Number DE92003010. Source: OSTI; NTIS; INIS; GPO Dep.

A generalized Runge-Kutta method has been employed in the numerical integration of the stiff space-time diffusion equations. The method is fourth-order accurate, using an embedded third-order solution to arrive at an estimate of the truncation error for automatic timestep control. The efficiency of the Runge-Kutta method is enhanced by a block-factorization technique that exploits the sparse structure of the matrix system resulting from the space and energy discretized form of the time-dependent neutron diffusion equations. Preliminary numerical evaluation using a one-dimensional finite difference code shows the sparse matrix implementation of the generalized Runge-Kutta method to be highly accurate and efficient when compared to an optimized iterative theta method. 12 refs., 5 figs., 4 tabs.

8130 (KEK–90-25(v.1), pp. 362-368) **Benchmark experiment for material penetration of several tens MeV neutrons.** Shin, Kazuo (Kyoto Univ. (Japan). Faculty of Engineering); Uwamino, Yoshitomo; Nakamura, Takashi; Numata, Shigeo; Kato, Takashi. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

This paper describes (i) benchmark experiments of intermediate energy neutron transmission through iron, lead and graphite shields and (ii) estimation of thick target neutron yield by high energy ^{4}He ions. In the neutron transmission experiments, a collimated beam of neutrons induced by 65-MeV protons in a thick Cu target was utilized in the measurements. Monte Carlo calculations by MORSE were carried out with the DLC-87 Hilo multigroup cross sections. It was found that the DLC-87 data reproduced the measured data well for the graphite shield, but gave partly higher values for the iron shield, and overpredicted the lead transmitted spectra. Neutron yields for stopping-length target of Cu and Be were estimated for ^{4}He ion bombardment with the intranuclear cascade evaporation Monte Carlo code, HETC/KFA-1. The results were obtained for ion energies from 100 MeV/u to 800 MeV/u. The neutron spectra were fitted to simple evaporation spectra and the systematics on the nuclear temperature was studied. Total neutron yield per incident ^{4}He ion was about 5 times larger than that per proton. (author).

8131 (KURRI-TR–345, pp. 16-34) **Calculation method for nuclear fission neutron spectra.** Ohsawa, Takaaki (Kinki Univ., Higashi-Osaka, Osaka (Japan). Atomic Energy Research Inst.). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Mar 1991. (In Japanese). (CONF-9008225–: Specialists' meeting on physics and engineering of fission and spallation; Specialists' meeting on physics and engineering of fission and spallation, Kumatori (Japan); Kumatori (Japan), 2 Aug 1990; 10 jan 1991; CONF-9101117–). In *Proceedings of the specialists' meeting on physics and engineering of fission and spallation, 1990.* 118p. Order Number DE92713857. Source: OSTI; NTIS (US Sales Only); INIS.

Though nuclear fission neutron spectra have the long history of research, still those are not resolved sufficiently. The first of the reason is that most of the measurement carried out so far were for the neutron fission of U-235 and the spontaneous nuclear fission of Cf-252, and for other nuclides, the reliable data lack. Second, even on U-235 (n,f) and Cf-252 (sf) having many data, the accuracy has not yet satisfied the requirement. Third, theoretically the mechanism of releasing fission neutrons is the cascade release from many fragments having various exciting energy, and the simple modeling is not easy. As seen from the application side, in relation to the research on the heightening of fuel burnup and the annihilation processing of actinides, the prompt neutron spectrum data for a variety of nuclides and wide incident energy become necessary. In this report, the conventional phenomenalism approach and the recent trend of the theoretical studies are described, and the Madland-Nix model which has been adopted recently for JENDL-3 and ENDF/B-4 is taken up, and its examination and the results of the attempt to improve the problems are described. (K.I.).

8132 (KURRI-TR–345, pp. 35-41) **Amount of forming neutrons by light and heavy ion reaction and permeation of produced neutrons through substances.** Hata, Kazuo (Kyoto Univ. (Japan). Faculty of Engineering). Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst. Mar 1991. (In Japanese). (CONF-9008225–: Specialists' meeting on physics and engineering of fission and spallation; Specialists' meeting on physics and engineering of fission and spallation, Kumatori (Japan); Kumatori (Japan), 2 Aug 1990; 10 jan 1991; CONF-9101117–). In *Proceedings of the specialists' meeting on physics and engineering of fission and spallation, 1990.* 118p. Order Number DE92713857. Source: OSTI; NTIS (US Sales Only); INIS.

Recently accelerators have become to be used for the purposes of wide range, as the result, the demand has become strong for the data on the shielding of the generation of radiation, radioactivation and radiation permeation. Generally when the shield for accelerators is considered, the generation of neutrons from a target and the permeation of those neutrons through substances are the fundamental matters. In this report, the generation of neutrons from targets by light ions and heavy ions having relatively low energy is described. Moreover, the permeation of the neutrons generated by the protons of several tens MeV through typical substances is shown. The amount of secondary neutron generation from thick targets by light ions increased as the incident ions and the target nuclei became heavier. The energy dependence was similar. However, the amount of neutron generation by heavy ions of 10 MeV/u was almost constant, regardless of incident ions and target nuclei. In the measurement, to the thick targets of C, Al, Cu, Pb and so on, p (30 MeV), p (52 MeV), d (33 MeV), alpha (65 MeV), He-3 (65 MeV) and C-12 (120 MeV) were applied, and the angle and energy distribution of the generated neutrons were measured. (K.I.).

8133 (ORNL/TM–11873) **DRC2: A code with specialized applications for coupling localized Monte Carlo adjoint calculations with fluences from two-dimensional R-Z discrete ordinates air-over-ground calculations.** Slater, C.O. Oak Ridge National Lab., TN (United States). Jan 1992. 76p. Sponsored by Defense Nuclear Agency. DOE Contract AC05-84OR21400. Order Number DE92005175. Source: OSTI; NTIS; GPO Dep.

The DRC2 code, which couples MASH or MASHX adjoint leakages with DORT 2-D discrete ordinates forward directional fluences, is described. The forward fluences are allowed to vary both axially and radially over the coupling surface, as opposed to the strictly axial variation allowed by the predecessor DRC code. Input instructions are presented along with descriptions and results from several sample problems. Results from the sample problems are used to compare DRC2 with DRC, DRC2 with DORT, and DRC2 with itself for the case of x-y dependence versus no x-y dependence of the forward fluence. The test problems demonstrate that for small systems DRC and DRC2 give essentially the same results. Some significant differences are noted for larger systems. Additionally, DRC2 results with no x-y dependence of the forward directional fluences are practically the same as those calculated by DRC.

6640 Atomic and Molecular Physics

Refer also to citation(s) 8233

6641 Theory of Electronic Structure of Atoms and Molecules

Refer also to citation(s) 8151

8134 (IC–91/269) **Quantum collapses and revivals from the k-photon Buck-Sukumar model.** Zhou Peng. International Centre for Theoretical Physics, Trieste (Italy). Sep 1991. 9p. Order Number DE92614416. Source: OSTI; NTIS (US Sales Only); INIS.

The quantum collapses and revivals of the atomic inversion in the k-photon Buck-Sukumar model are shown by means of numerical and approximate methods for various photon transition processes. (author). 17 refs, 3 figs.

6642 Spectra of Atoms and Molecules and Their Interactions With Photons

Refer also to citation(s) 7865

8135 (BNL–46809) **A high resolution x-ray fluorescence spectrometer for near edge absorption studies.** Stojanoff, V.; Hamalainen, K.; Siddons, D.P.; Hastings, J.B.; Berman, L.E.; Cramer, S.; Smith, G. Brookhaven National Lab., Upton, NY (United States). [1991]. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-910730–28: 4. international conference on synchrotron radiation instrumentation, Chester (United Kingdom), 15-19 Jul 1991). Order Number DE92004991. Source: OSTI; NTIS; INIS; GPO Dep.

A high resolution fluorescence spectrometer using a Johann geometry in a back scattering arrangement was developed. The spectrometer, with a resolution of 0.3 eV at 6.5 keV, combined with an incident beam, with a resolution of 0.7 eV, form the basis of a high resolution instrument for measuring x-ray absorption spectra. The advantages of the instrument are illustrated with the near edge absorption spectrum of dysprosium nitrate. 10 refs., 4 figs.

8136 (DOE/ER/13964–3) **Radiative interactions with micromachined surfaces: Spectral polarized emittance: Final report, 1 August 1990–31 July 1991.** Zemel, J.N. Pennsylvania Univ., Philadelphia, PA (United States). Dept. of Electrical Engineering. [1991]. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER13964. (CONF-9105275–1: Micro-macro studies of multiphase media, Argonne, IL (United States), 9-11 May 1991). Order Number DE92001742. Source: OSTI; NTIS; GPO Dep.

The spectral, angular, polarized emittance (SAPE) is a simple means for observing the allowed electromagnetic energy states associated with periodic structures whose dimensions are comparable to the wavelength of the observed light. Other methods for measuring absorption are far more time consuming when a broad survey is of interest. An extensive body of SAPE data was obtained on 350– 400°C intrinsic silicon lamellar gratings. Current approximations to the vector wave equation such as guided wave, modal and Bloch wave methods provided insight into our experiments. A qualitative picture of the stationary electromagnetic states (SES) of lamellar gratings has been developed which agrees with experiment for a number of polarizations, and angular orientations of the emission k vector relative to the gratings. However, one type of emission does not fit any simple model we have examined and raises intriguing questions about emission from grating structures. A new, higher angular resolution emissometer (0.8° instead of 5°)

has been completed. This system significantly increases the wavelength range from the current 3–14 μm range to 2-25μm, a doubling of the spectral regime. The system is currently in a "shakedown" mode. Preliminary data indicates that the new emissometer meets the design goals. 24 refs., 10 figs.

8137 (DOE/ER/14066–1) **[High-resolution Raman spectroscopy of complexes and clusters in molecular beams]: Progress report.** California Univ., Los Angeles, CA (United States). [1991]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract FG03-89ER14066. Order Number DE92004834. Source: OSTI; NTIS; INIS; GPO Dep.

No abstract available.

8138 (DOE/ER/14066–2) **[High resolution Raman spectroscopy of complexes and clusters in molecular beams]: Progress report.** Felker, P.M. California Univ., Los Angeles, CA (United States). [1991]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract FG03-89ER14066. Order Number DE92004836. Source: OSTI; NTIS; INIS; GPO Dep.

No abstract available.

8139 (DOE/ER/14066–3) **High resolution Raman spectroscopy of complexes and clusters in molecular beams: Performance report.** Felker, P.M. California Univ., Los Angeles, CA (United States). [1991]. 40p. Sponsored by U.S. DOE Energy Research. DOE Contract FG03-89ER14066. Order Number DE92004206. Source: OSTI; NTIS; INIS; GPO Dep.

The DOE-sponsored project in this laboratory has two facets. The first is the development of methods of nonlinear Raman spectroscopy for application in studies of sparse samples. The second is the application of such methods to structural and dynamical studies of species in supersonic molecular beams. The progress we have made in both of these areas is described in this paper. The report is divided into five remaining sections. The first pertains to theoretical and experimental developments in Fourier transform stimulated emission spectroscopy and Fourier transform hole-burning spectroscopy. The second deals with progress in the development of ionization-detected stimulated Raman spectroscopies (IDSRS). The third describes results from the application of IDSRS methods to studies of jet-cooled benzene clusters. The fourth describes IDSRS results from studies of hydrogen-bonded complexes containing phenols. The fifth relates to studies of carbazole-$(Ar)_n$ clusters.

8140 (DOE/ER/60504–T1) **[Theoretical problems in laser spectroscopy of atoms and molecules]: Progress report.** Lambropoulos, P.P. University of Southern California, Los Angeles, CA (United States). Dept. of Physics. [1991]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract FG03-87ER60504. Order Number DE92003761. Source: OSTI; NTIS; INIS; GPO Dep.

Short communication. ATOMS/laser spectroscopy; MOLECULES/laser spectroscopy; PROGRESS REPORT; HEAT PIPES; IONIZATION; XENON; CALCIUM; SODIUM; ATOMS; MOLECULES

8141 (IC–91/240) **Exactly soluble model for parametric processes.** Biswas, A.K.; Shumovsky, A.S. International Centre for Theoretical Physics, Trieste (Italy). Aug 1991. 10p. Order Number DE92615394. Source: OSTI; NTIS (US Sales Only); INIS.

The new third-order model for the parametric process is considered and the statistical properties for the first two excited states are examined. (author). 3 refs, 2 figs.

8142 (LAMP–91/6) **Investigations of breakdown of rare gases by short pulses of 1.06μm laser radiation.** LAMP series report (Laser, Atomic and Molecular Physics). Gamal, Y.E.E.D. (International Centre for Theoretical Physics, Trieste (Italy)); Shafik, M.S. International Centre for Theoretical Physics, Trieste (Italy). Aug 1991. 14p. Order Number DE92615399. Source: OSTI; NTIS (US Sales Only); INIS.

An analysis based on a numerical integration of the equation which governs the total growth rate of the electron density due to the combined effect of multiphoton ionization and electron cascade ionization processes is presented. The calculations are carried out for argon and xenon gases in the pressure range $1.0\text{-}5\text{x}10^3$ Torr illuminated with 10ps pulses of 1.06μm laser radiation. This analysis shows that the two ionization processes (multiphoton and electron cascade) play an important role over the whole pressure regime considered. At low pressures ($<$ 300 Torr) the breakdown is governed solely by the multiphoton process, indicated by the weak dependence of the threshold intensity on the gas pressure. At higher pressures ($<$ 760 Torr) however, a strong pressure dependence of the threshold intensity is observed. This is considered as evidence for the domination of the cascade ionization process at these pressures. On the pressure range 200-760 Torr a slight decrease of the threshold intensity is observed for both gases. This is attributed to the minor role played by the cascade ionization process together with the multiphoton ionization process at these pressures. The calculated thresholds for argon and xenon are consistent with those experimentally measured. (author). 15 refs, 4 figs.

6643 Collision Phenomena

Refer also to citation(s) 7415, 8153, 8155

8143 (DOE/ER/13491–508) **Atomic physics with highly charged ions: Progress report, FY 1989–91.** Richard, P. Kansas State Univ., Manhattan, KS (United States). J.R. MacDonald Lab. Aug 1991. 104p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER13491. Order Number DE92004028. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses: One electron outer shell processes in fast ion-atom collisions; role of electron-electron interaction in two-electron processes; multi-electron processes at low energy; multi-electron processes at high energy; inner shell processes; molecular fragmentation studies; theory; and, JRM laboratory operations.

8144 (DOE/ER/13849–4) **Low energy ion-molecule reactions and chemiionization kinetics: Progress report, February 1, 1991–January 31, 1992.** Farrar, J.M. Rochester Univ., NY (United States). 25 Sep 1991. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER13849. Order Number DE92005083. Source: OSTI; NTIS; INIS; GPO Dep.

Our research program is devoted to understanding the dynamics of elementary ionic collisions at the level of the underlying potential surface by measuring energy and angular distributions of reactively scattered products with crossed beam methods over the relative center-of-mass energy range from 0.3 to several eV. We have performed reactive and non-reactive scattering studies on the proton and hydrogen atom transfer systems listed below: $O + NH_3 \rightarrow OH + NH_2$ $\delta H = -0.2$ eV $O + H_2O \rightarrow OH + OH$ $\delta H = +0.4$ eV. In both of these systems, the reactions are hypothesized to occur on potential energy surfaces having two minima. The first minimum corresponds to the formation of an electrostatically bound complex, e.g., $O(H_2O)$, followed by an intramolecular hydrogen atom/proton transfer to yield OH·OH, which may then form the products by cleavage of the complex.

8145 (EGG–10617-5093) **A new relativistic collision rate calculation.** Graham, G. EG and G Energy Measurements, Inc., Los Alamos, NM (United States). Los Alamos Operations. 19 Aug 1991. 47p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC08-88NV10617. (LAO–2732-2172). Order Number DE92003690. Source: OSTI; NTIS; GPO Dep.

The collision rates that are used in RELFLAP, the relativistic fluid code for high-power microwave propagation through the atmosphere, are obtained from the first three moments of the relativistic Boltzmann collision integral. Expressions for the particle, momentum, and energy transfer rates caused by elastic, inelastic, and ionizing collisions were previously obtained by evaluating the moments of the relativistic Boltzmann collision integrals using a relativistic momentum distribution function and assuming scattering cross sections that are independent of the scattering angle. The resulting integral expressions are evaluated numerically over a two-dimensional grid of mean kinetic and thermal velocity in the code RELFCOL. The purpose of this memorandum is to document the calculation of new relativistic collision rates using angular dependent scattering cross sections. This new calculation is based on a similar nonrelativistic treatment given by Roussel-Dupre and on the earlier relativistic rate calculation. The earlier calculation was based on the incorrect assumption that the collision rates were proportional to the normalized mean electron momentum. This assumption yields unnaturally large collision rates for the extreme relativistic case. In fact, the rates for collisions between electrons and stationary neutral particles are proportional to the mean electron velocity. The new rate calculation is based on this fact. New derivations of the Boltzmann collision integrals, similar to the original derivations, are presented. Relativistic scattering cross sections are discussed. Expressions for the particle, momentum, and energy transfer rates were derived using differential scattering cross sections. Some of the computational methods used to calculate the collision rate and the results of the rate calculation are discussed.

8146 (GSI–91-56(prepr.)) **Ionization of hydrogen by a relativistic heavy projectile.** Hofstetter, S. (Giessen Univ. (Germany). Inst. fuer Theoretische Physik 2); Hofmann, C.; Soff, G. Gesellschaft fuer Schwerionenforschung mbH, Darmstadt (Germany). Oct 1991. 17p. Order Number DE92759313. Source: OSTI; NTIS (US Sales Only); INIS.

Using a relativistic analogue of the classical trajectory Monte-Carlo method we investigate the influence of the magnetic field of a relativistic heavy projectile on the ionization cross section of hydrogen. In particular we focus our attention on the angular and energy distribution of the emitted delta electrons. (orig.).

8147 (INIS-mf–13026, pp. 301-302) **K-shell vacancies at oxygen ions moving inside thin ferromagnetic foils.** Tribedi, L.C. (Tata Inst. of Fundamental Research, Bombay (India)); Pillay, R.G.; Prasad, K.G.; Tandon, P.N. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. OXYGEN IONS/k shell; OXYGEN 16 BEAMS/ferromagnetic materials; CHARGE STATES; COBALT; IRON; LI-DRIFTED SI DETECTORS; MEV RANGE 10-100; NICKEL; SILICON; SILICON OXIDES; TARGETS; VACANCIES; X-RAY SPECTRA

8148 (INIS-mf–13068) **Coherence in electron-impact excitation of helium.** Batelaan, Hermanus. Rijksuniversiteit Utrecht (Netherlands). 10 Jun 1991 101p. Order Number DE92614420. Source: OSTI; NTIS (US Sales Only); INIS.

This work was performed as part of the research program of the 'Stichting voor Fundamenteel Onderzoek der Materie FOM' (Foundation for Fundamental Research into Matter), with financial support from the 'Nederlandse Organisatie voor Wetenschappelijk Onderzoek WNO' (Netherlands Organization for Scientific Research); Includes summary in Dutch.

This thesis describes an experimental study into the electron-impact excitation to the 3^3P, 3^1D and 3^3D states of Helium. The scattered electron and the photon, emitted by the excited atom, are measured in coincidence. The parameters, which can be varied, are the scattering angle and the kinetic energy of the projectile. Two parameters, which are used to characterize the excited state, are the angular momentum transferred to the atom, L perpendicular, and the alignment angle γ. It is shown that results of measurements on 3^1D excitation with photon detection perpendicular to the scattering plane do not agree in the small scattering angle region with any of the model calculations currently available. Remarkable is the sign of L perpendicular, which appears to start of negatively at 60 eV. It is shown that for 3^3P excitation the predicted large value of γ is indeed found experimentally. This supports the suggestion that exchange scattering is underestimated in model calculations for ^1P excitation. Another result is that for ^1P and ^3P excitation the behaviour of L perpendicular as a function of the scattering angle can be related at different impact energies with the help of a partial wave expansion. A scaling relation can be formulated for the behaviour of L perpendicular. The influence of a negative ion resonance to excitation of the 3^3D state is investigated. Both in coincidence and non-coincidence measurements the presence of the resonance yields information on both the direct and indirect excitation of the 3^3D state. It is shown that the coincident measurement gives an unique opportunity to determine the excited 3^3D state completely. Results of measurements with photon detection in the scattering plane are given. They supplement previous 3^1D and 3^3D results and allow physical parameters, such as L perpendicular and γ, to be obtained. (H.W.). 132 refs.; 20 figs.; 18 tabs.

8149 (LA-UR–91-3849) **Dielectronic recombination theory.** LaGattuta, K.J. Los Alamos National Lab., NM (United States). [1991]. 12p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-9110313–1: NATO workshop on recombination of atomic ions, Belfast (Ireland), 6-9 Oct 1991). Order Number DE92005020. Source: OSTI; NTIS; INIS; GPO Dep.

A theory now in wide use for the calculation of dielectronic recombination cross sections (σ^{DR}) and rate coefficients (α^{DR}) was one introduced originally by Feshbach for nuclear physics applications, and then later adapted for atomic scattering problems by Hahn. In the following, we briefly review this theory in a very general form, which allows one to account for the effects of overlapping and interacting resonances, as well as continuum-continuum coupling. An extension of our notation will then also allow for the inclusion of the effects of direct radiative recombination, along with a treatment of the interference between radiative and dielectronic recombination. Other approaches to the calculation of σ^{DR} have been described by Fano and by Seaton. We will not consider those theories here. Calculations of α^{DR} have progressed considerably over the last 25 years, since the early work of Burgess. Advances in the reliability of theoretical predictions have also been promoted recently b a variety of direct laboratory measurements of σ^{DR}. While the measurements of σ^{DR} for $\delta n \neq 0$ excitations have tended to agree very well with calculations, the case of $\delta n = 0$ has been much problematic. However, by invoking a mechanism originally proposed by Jacobs, which takes into account the effect of stray electric fields on high Rydberg states (HRS) participating in the DR process, new calculations have improved the agreement between theory and experiment for these cases. Nevertheless, certain discrepancies still remain.

6644 Experimentally Derived Information On Atomic and Molecular Properties

Refer also to citation(s) 6903, 8140, 8143

8150 (BONN-IR–91-28) **Coulomb correlations in many-electron systems on the level of self-consistent fields.** Warken, M. Bonn Univ. (Germany). Physikalisches Inst.; Bonn Univ. (Germany). Mathematisch-Naturwissenschaftliche Fakultaet. Jun 1991. 35p. (In German). Order Number DE92758859. Source: OSTI; NTIS (US Sales Only); INIS.

It was the aim of this thesis to show means and ways, in order to regard Coulomb correlation already on the SCF level. As mean to facilitate this general averaged fields should serve. For this first in chapter I was shown, how by means of suitable gauge fixings terms into effective potentials of the Hartree-Fock or g-Hartree type are introduced, which permit an interpretation as correlation density or as effective coupling constant. The following considerations were exemplarily performed on the cases g-Hartree (in Coulomb gauge) and on f-Hartree-Fock. (orig./HSI).

8151 (CONF-920124–4) **Suppression and shifting of odd-photon resonant excitations and stimulated hyper-Raman emissions.** Garrett, W.R.; Payne, M.G. Oak Ridge National Lab., TN (United States). [1991]. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Society of Photo-Optical Instrumentation Engineers' international symposium on laser spectroscopy as part of SPIE's symposium on optics, electro-optics and laser applications in science and engineering; Los Angeles, CA (United States); 19-24 Jan 1992 Order Number DE92005116. Source: OSTI; NTIS; GPO Dep.

When a principal atomic transition (dipole allowed from the ground state) is driven by odd-multi-photon excitation or by stimulated hyper-Raman scattering, a nonlinear multi-wave mixing field is generated at the transition frequency. A number of dramatic effects on such odd-photon mediated processes can ensue as a result of the internally generated wave-mixing fields. Excellent agreement between theory and experimental studies in Xe and in metal vapors is illustrated for a number of predicted effects including: suppression and strong shifting of resonance lines and hyper-Raman emissions under single and multi-laser excitation. We illustrate the dependence of the interference-related effects on pressure, oscillator strength, wavelength combination and relative propagation directions of pump laser beams. Contrary to most other nonlinear effects, we show that none of the features (in the semi-classical regime) depends on the intensity of the driving laser field.

8152 (CONF-9106284-2-Extd.Abst.) **Collinear fast beam laser spectroscopy of the neutron-deficient thallium isotopes.** Schuessler, H.A. (Texas A and M Univ., College Station, TX (United States). Dept. of Physics); Benck, E.C.; Li, Y.F.; Buchinger, F.; Iimura, H.; Bingham, C.R.; Carter, H.K. Oak Ridge National Lab., TN (United States). [1991]. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400 ;AC05-76OR00033 ;AS05-80ER10578. From 10. international conference on laser spectroscopy; Font-Romeu (France); 17-21 Jun 1991. Order Number DE92005166. Source: OSTI; NTIS; INIS; GPO Dep.

The isotope shifts and the hyperfine structure constants of the I = 7 neutron-deficient ^{188,192}Tl isotopes were observed for the λ = 535 nm line of neutral thallium. An optical detection efficiency of 2 x 10^{-4} photons per radioactive ion was achieved with a large solid angle fiber optical array detector.

8153 (CONF-9108105-5) **Recombination of highly charged ions with free electrons.** Mueller, A. (Giessen Univ. (Germany)); Frank, A.; Haselbauer, J.; Hofmann, G.; Neumann, J.; Pracht, U.; Salzborn, E.; Schennach, S.; Spies, W.; Stenke, M.; Uwira, O.; Voelpel, R.; Wagner, M.; Becker, R.; Jennewein, E.; Kleinod, M.; Proebstel, U.; Phaneuf,.Oak Ridge National Lab., TN (United States). [1991]. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 8. topical conference on atomic processes in plasmas; Portland, ME (United States); 25-29 Aug 1991. Order Number DE92004228. Source: OSTI; NTIS; INIS; GPO Dep.

Recombination of highly charged ions and free electrons is studied in interacting-beams experiments. Beside direct recombination into bound states by radiative capture a variety of resonant recombination phenomena is observed. Resonant recombination produces a highly excited, usually short lived electron-ion compound which can stabilize by the emission of photons and/or electrons. Depending on this emission, the final charge state of the ion can be one less than the parent charge state, but it can also be higher and thus a net single or multiple ionization of the ion is observed after the initial recombination. 14 refs., 7 figs.

8154 (INIS-mf-13079) **A compact copper nuclear demagnetization cryostat and a search for superfluidity in solid ^{4}He.** Haar, P.G. van de. Rijksuniversiteit Leiden (Netherlands). 17 Oct 1991 158p. Order Number DE92614426. Source: OSTI; NTIS (US Sales Only); INIS.

Includes summary in Dutch.

The subject of this thesis is the theoretical and experimental study of matter at low temperatures, and the development of techniques to reach and measure these temperatures. A copper nuclear demagnetization cryostat was developed in order to reach low temperatures. This system distinguishes itself from other cryostats by its compact construction. The lowest temperature recorded by a pulsed Pt-NMR thermometer was 115 μK. This system was used to search for superfluidity in solid ^{4}He. Due to the large zero-point motion of the atoms, 4He remains liquid down to zero temperature; a pressure of 25.3 bar is needed to force the atoms in a lattice. Even in solid state, the ^{4}He atoms remain very mobile, changing lattice sites at a frequency of approximately 10^7 Hz. It is possible that solid ^{4}He contains vacancies at zero temperature. These zero point vacancies are expected to behave like a gas of bosons, and should Bose-condense at some temperature. From experiments the upper limit to the vacancy concentration is set of 4·10-5. (author). 217 refs.; 46 figs.; 2 tabs.

8155 (LAMP-91/3) **Single photon double ionization of helium.** LAMP series report (Laser, Atomic and Molecular Physics). Tiwary, S.N. International Centre for Theoretical Physics, Trieste (Italy). May 1991. 15p. Order Number DE92609186. Source: OSTI; NTIS (US Sales Only); INIS.

we have calculated the single photon double ionization cross section of helium using the fully correlated wave function for the ground state and partially correlated wave function for the final state. Our present theoretical investigation demonstrates that the inclusion of the full correlation in the initial as well as the final state wave function is indispensable in order to obtain reliable results in the close vicinity of the threshold. (author). 56 refs, 1 fig.

6645 Special Atoms and Molecules

Refer also to citation(s) 7968

6650 Physics of Condensed Matter

Refer also to citation(s) 6795, 7820

8156 (CONF-911202-7) **Real-space multiple scattering theory method: Formalism and applications.** Zhang, X.G. Kentucky Univ., Lexington, KY (United States). Center for Computational Sciences. [1991]. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Annual fall meeting of the Materials Research Society; Boston, MA (United States); 2-6 Dec 1991. Order Number DE92004240. Source: OSTI; NTIS; GPO Dep.

Different forms of the real-space multiple scattering theory (RS-MST) formalism are compared in order to understand its convergence behavior with respect to truncation in the angular momentum expansions. In particular the so-called "folding method" or (1,n) mode is considered, in which the renormalized t-matrix T of the semi-infinite system has the dimension of n (n > 1) repeating units and the self-consistent equation for T is constructed by adding and contracting one such unit. It has been demonstrated in previous studies of layered structures that the folding method converges rapidly in both angular momentum (L) and site (n) indices and yields accurate results. The convergence behavior is an important factor to be considered in applying the various forms of the RS-MST method to layered structures as well as other systems with extended defects. 10 refs., 6 figs.

8157 (DOE/ER/14100-1) **Hydrodynamic instabilities and coherent structures: Progress report, January 1, 1991-December 31, 1991.** Frenkel, A. Alabama Univ., University, AL (United States). Dept. of Mathematics. Aug 1991. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-90ER14100. Order Number DE92004077. Source: OSTI; NTIS; GPO Dep.

This report briefly discusses electrically conducting fluids, Kolmogorov flow, triangular-eddy flow, thin film flow, and core-annular flow. (LSP)

8158 (DOE/ER/25061-T1) **Initial-value problems and stability in shear flows.** Criminale, W.O. Washington Univ., Seattle, WA (United States). Dept. of Applied Mathematics. Oct 1991. 21p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-88ER25061. (TR-91-13). Order Number DE92004391. Source: OSTI; NTIS; GPO Dep.

It is the plan of this presentation of outline three major topics of the novel analysis. (1) Use of exact solutions in solving initial-value problems; (2) detailed linear example that illustrates the relevant of the early period and possible instability; (3) Lagrangian mechanics and the link to computational fluid dynamics.

8159 (DOE/ER/45275-5) **Surface and interface electronic structure: Fifth year progress report.** Kevan, S.D. Oregon Univ., Eugene, OR (United States). [1991]. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-86ER45275. Order Number DE92004388. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses: surface states and resonances on Ta(011); surface states and phonon anomalies on Pt(111); and surfaces fermi contours and charge transfer.

8160 (DOE/ER/45437-1) **Surface and interfacial properties of polymer blends: Progress report, September 25, 1990-December 24, 1991.** Rafailovich, M.; Sokolov, J. Queens Coll., Flushing, NY (United States). Dept. of Physics. Nov 1991. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-90ER45437. Order Number DE92004074. Source: OSTI; NTIS; GPO Dep.

This is a summary of the research we have conducted since receiving our DOE grant and research plans for the coming year. As you will notice most of the research objectives of our original proposal were met, especially in regard to measuring surface segregation and interface formation in polymer blends. Our program has therefore expanded into other directions such as the study of the surface visco-elastic properties of polymer liquids and solutions, the conformations of polymer chains grafted onto silica surfaces, and the dynamics of cross linked polymer networks.

8161 (IC–91/179) **Magneto-optical phenomena in semiconductor superlattices.** Nguyen Hong Shon. International Centre for Theoretical Physics, Trieste (Italy). Jul 1991. 10p. Order Number DE92615480. Source: OSTI; NTIS (US Sales Only); INIS.

The Faraday and birefringence effects due to infrared radiation in semiconductor superlattices under quantized magnetic field are investigated. It is shown that for non-degenerate electron gas in the one mini-band approximation the frequency behaviour of magneto-optical coefficients exhibit finite jumps at $\omega=\eta\omega_c\pm2\Delta$ (ω is the frequency of electromagnetic radiation, ω_c is the cyclotron frequency and Δ is half band width). The natural birefringence and dichroism in superlattices are also calculated. (author). 9 refs, 1 fig.

8162 (IC–91/191) **Instability of the paramagnetic state in the kinematic field approximation in the Hubbard model.** Gorvachev, E.G. International Centre for Theoretical Physics, Trieste (Italy). Jul 1991. 5p. Order Number DE92615481. Source: OSTI; NTIS (US Sales Only); INIS.

Within the scope of the approximation of a kinematic field I have been calculating the uniform paramagnetic susceptibility $\chi(0,0)=\delta R(H)/\delta H$ when $H \to 0$ and $U \to \infty$. It turns out that $\chi(0,0) < 0$ in the all region, where $R=0$ (i.e. $0,7 >$ or approx. $n \geq 0$). (author). 6 refs, 1 fig.

8163 (IC–91/224) **The odd Voigt effect under a strong electric field in semiconductors.** Nguyen Hong Shon. International Centre for Theoretical Physics, Trieste (Italy). Aug 1991. 10p. Order Number DE92615482. Source: OSTI; NTIS (US Sales Only); INIS.

The high frequency conductivity tensor $\sigma_{ik}(\omega)$ in the linear approximation of magnetic field H and in the quadratic approximation of external dc electric field is derived by solving Boltzmann equation. The magneto-optical phenomena in the Voigt configuration (when a probe electro-magnetic wave propagates across a magnetic field) are investigated. It is shown that the birefringence and dichroism have a component that is odd (linear) in the magnetic fields and predominate over the even effect in the weak magnetic field. (author). 8 refs.

8164 (IC–91/242) **The influence of contraction in the first interplane distance on the surface states of Ta(001).** Baquero, R. (International Centre for Theoretical Physics, Trieste (Italy)); Coss, R. de. International Centre for Theoretical Physics, Trieste (Italy). Aug 1991. 4p. Order Number DE92615483. Source: OSTI; NTIS (US Sales Only); INIS.

We analyze the influence that the recently found Ta(001) first interatomic layer contraction has on the surface electronic structure. We find that the states near the Fermi energy at the Γ point on the 2D First Brillouin zone found in recent experiments are directly related to this contraction. In general, our calculation shows a better agreement with experiment than previous work. The remaining small differences might be attributable to a possible smaller but non-negligible contraction of the second interatomic layer distance. (author). 8 refs, 1 fig.

8165 (IC–91/246) **A probabilistic mechanism hidden behind the universal power law for dielectric relaxation. 1 - General relaxation equation.** Weron, K. International Centre for Theoretical Physics, Trieste (Italy). Aug 1991. 24p. Order Number DE92615484. Source: OSTI; NTIS (US Sales Only); INIS.

A new model for the explanation of the universal dielectric response law is proposed. It differs significantly from all previous works on the subject. The presented model is based on the assumption that individual dipoles and their environment do not remain independent during the process of relaxation. Therefore, the time θ_i, needed for the regression to equilibrium of polarization fluctuations in a random variable which depends for each relaxing dipole on two other random variables: the waiting time η_i and the dissipation rate β_i. As a consequence we derive a general relaxation equation which gives the universal dielectric response in the power law form (as a special case the stretched exponential form is obtained). (author). 47 refs, 2 figs.

8166 (IC–91/247) **A probabilistic mechanism hidden behind the universal power law for dielectric relaxation. 2 - Discussion of the response function.** Weron, K. International Centre for Theoretical Physics, Trieste (Italy). Aug 1991. 19p. Order Number DE92615485. Source: OSTI; NTIS (US Sales Only); INIS.

This paper is a continuation of our previous work, where the new probabilistic model based directly on the reaction picture of relaxation was introduced and a general relaxation equation was derived. Here we show the universal character of distributions of damping rates and waiting times used in this model. Moreover, we discuss in detail a physical significance of the response function derived as a solution of the general relaxation equation. (author). 23 refs, 4 figs.

8167 (IC–91/276) **Optical properties of metallic multi-layer films.** Dimmich, R. International Centre for Theoretical Physics, Trieste (Italy). Sep 1991. 24p. Order Number DE92615486. Source: OSTI; NTIS (US Sales Only); INIS.

Optical properties of multi-layer films consisting of alternating layers of two different metals are studied on the basis of the Maxwell equations and the Boltzmann transport theory. The influence of free-electron scattering at the film external surface and at the interfaces is taken into account and considered as a function of the electromagnetic field frequency and the structure modulation wavelength. Derived formulas for optical coefficients are valid at low frequencies, where the skin effect is nearly classical, as well as in the near-infrared, visible and ultraviolet spectral ranges, where the skin effect has the anomalous nature. It is shown that the obtained results are apparently dependent on the values of the scattering parameters. What is more, the oscillatory nature of analyzed spectra is observed, where the two oscillation periods may appear on certain conditions. The oscillations result from the electron surface and interface scattering and their amplitudes and periods depend on the boundary conditions for free-electron scattering. Finally, the application of the interference phenomenon in dielectric layers is proposed to obtain the enhancement of the non distinct details which can appear in optical spectra of metallic films. (author). 31 refs, 6 figs.

8168 (IC–91/283) **Carrier-influenced bistable behaviour in ring cavity configuration.** Nguyen Ba An (International Centre for Theoretical Physics, Trieste (Italy)); Nguyen Trung Dan; Hoang Xuan Nguyen. International Centre for Theoretical Physics, Trieste (Italy). Aug 1991. 15p. Order Number DE92615487. Source: OSTI; NTIS (US Sales Only); INIS.

Bistable output-input light characteristics in the exciton spectral region have been examined in a ring cavity configuration taking into account the influence of the presence of free carriers in the cavity as well as of the density-dependence of the exciton damping. The resulting modifications could serve as a means to optimize the optical bistable device operation. (author). 18 refs, 3 figs.

8169 (IC–91/286) **Phase transition in IV-VI compound semiconductors at high pressures.** Gupta, D.C. (International Centre for Theoretical Physics, Trieste (Italy)); Singh, R.K. International Centre for Theoretical Physics, Trieste (Italy). Sep 1991. 17p. Order Number DE92614534. Source: OSTI; NTIS (US Sales Only); INIS.

The high pressure phase transitions, the equation of state and associated volume collapses of IV - VI compound semiconductors have been analysed by means of a three-body potential (TBP) model approach. The charge-transfer effects, arising from the overlapping or deformation of the electron shells of the adjacent ions leading to the many-body (three-body) interactions, are included explicitly in the crystal potential. The TBP model explains successfully the large Cauchy-discrepancy in these IV-VI semiconductors. The agreement between the present theoretical and available experimental values on the phase transition pressures (P_t = 196, 148, 108 and 226 kbar), cohesive energy and lattice parameters are in reasonably good agreement in almost all the materials under consideration. The charge-transfer effect shows an appreciable influence on the phase transition properties of these materials. (author). 23 refs, 4 figs, 3 tabs.

8170 (IS-T–1584) **Theoretical study of hydrogen in α-YH_x and on Si(111) surface.** Min, B.J. Ames Lab., IA (United States). 20 Dec 1991. 97p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. Order Number DE92005096. Source: OSTI; NTIS; INIS; GPO Dep.

Thesis submitted to Iowa State University.

A first principles total energy calculation is performed to study hydrogen in an hcp metal, Y, under a Born-Oppenheimer approximation between Y and H. The equilibrium interstitial location, heat of formation, the change in the lattice constants and the bulk moduli, and the vibration frequencies of hydrogen are in excellent agreement with the experiment. However, the Born-Oppenheimer approximation is unable to make a quantitative prediction about the energy level splitting and hydrogen energy barrier between the interstitial sites. It would be out of reach to address these problems via a first principles technique. With this in mind, an empirical tight binding model is constructed for the simpler Si:H system and applied in a molecular dynamics simulation to study the hydrogen vibration on Si(111) surface. Our empirical tight binding model is able to provide an efficient and yet accurate description of hydrogen vibrations in the SiH_4 molecule and on the Si(111) surface. The frequency shift of the hydrogen stretching mode with temperature is investigated. The coupling between the hydrogen wagging mode and the Si substrate mode is verified. Also we have observed that there is a strong coupling between the hydrogen stretching mode and the wagging mode. It is hoped that this model would find greater use as computational capacity continues to grow rapidly.

8171 (LA-UR–91-4097) **Vibrational spectroscopy in high temperature dense fluids.** Moore, D.S.; Schmidt, S.C. Los Alamos National Lab., NM (United States). [1992]. 8p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract W-7405-ENG-36. (CONF-920124–3: Society of Photo-Optical Instrumentation Engineers' international symposium on laser spectroscopy as part of SPIE's symposium on optics, electro-optics and laser applications in science and engineering, Los Angeles, CA (United States), 19 Order Number DE92005052. Source: OSTI; NTIS; GPO Dep.

Coherent anti-Stokes Raman spectroscopy (CARS) in conjunction with a two-stage light-gas gun has been used to obtain vibrational spectra of shock-compressed liquid N_2, O_2, CO, and their mixtures, as well as liquid N_2O. The experimental spectra are compared to spectra calculated using a semiclassical model for CARS intensities to obtain vibrational frequencies, peak Raman susceptibilities, and linewidths. The derived spectroscopic parameters suggest thermal equilibrium of the vibrational populations is established in less than a few nanoseconds after shock passage. Vibrational temperatures obtained are compared to those derived from equation-of-state calculations. The variation of the vibrational frequency shift at pressure with species concentration in mixtures is investigated.

8172 (UCRL-JC–10872) **Numerical simulation of accelerated interfaces.** Marcus, D.L. (Lawrence Livermore National Lab., CA (United States)); Bell, J.B.; Puckett, E.G.; Saltzman, J. Lawrence Livermore National Lab., CA (United States). 21 Oct 1991. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-9106222–10: Workshop on physics of compressible, turbulent mixing, Royaumont (France), 17-19 Jun 1991). Order Number DE92004670. Source: OSTI; NTIS; GPO Dep.

We describe two numerical methods that have been designed to model the dynamics of accelerated interfaces. One method is based on the numerical approximation of the incompressible, variable-density Navier-Stokes equations while the other is based on a numerical approximation of the Euler equations. One feature that these methods share is that the numerical approximation to the governing fluid flow equations is accomplished in part by means of a second order extension of Godunov's method. We present the results of computations to model Rayleigh-Taylor instability and Richtmyer-Meshkov instability. 22 refs., 11 figs.

8173 (UCRL-JC–107425) **Effects of preheat on mix in laser accelerated planar foils.** Molitoris, J.D. (Lawrence Livermore National Lab., CA (United States)); Phillion, D.W.; Morin, M.M.; Goldsack, T.J.; Rothman, S.D.; Hansom, J.C.V. Lawrence Livermore National Lab., CA (United States). [1991]. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9106222–11: Workshop on physics of compressible, turbulent mixing, Royaumont (France), 17-19 Jun 1991). Order Number DE92004667. Source: OSTI; NTIS; INIS; GPO Dep.

We have investigated the effect of x-ray preheat on the development of mix. In these experiments a planar foil package consisting of two materials separated by a smooth interface was ablatively accelerated using a laser produced x-ray drive source. In the normally preheated case the drive had a component which coupled to the interface, while in the low preheat case that component was absent. The measured mix widths and hydrodynamics are compared for both situations. 12 refs., 10 figs.

6651 Nuclear Techniques In Condensed Matter Physics

8174 (ECN-RX–91-059) **Positron-annihilation 2D-ACAR measurements in $Bi_2Sr_2CaCu_2O_{8+x}$: Contribution to Workshop on fermiology of high-T_c superconductors, Argonne, March 25-27, 1991.** Mijnarends, P.E. (Netherlands Energy Research Foundation, Petten (Netherlands)); Melis, A.F.J.; Weeber, A.W. Netherlands Energy Research Foundation, Petten (Netherlands). Jun 1991. 6p. (CONF-9103112–: Conference on fermiology of high T_c superconductors, Argonne, IL (United States), 25-27 Mar 1991). Order Number DE92614536. Source: OSTI; NTIS (US Sales Only); INIS.

To be published in Journal of physics and chemistry of solids.

The authors present a brief account of measurements of the two-dimensional angular correlation of annihilation radiation (2D-ACAR) in a single crystal of approximate composition $Bi_2Sr_2CaCu_2O_{8+x}$ (T_c 85 K) at 6 and 92 K. The most noteworthy result is that the anisotropic part of the spectra displays a fine-structure which is sharpest at the higher of these two temperatures. (author). 17 refs.; 1 fig.

8175 (IC–91/280) **Relaxation of local moments diluted in $CePd_3$-intermediate valence compound.** Venegas, P. (International Centre for Theoretical Physics, Trieste (Italy)); Barberis, G. International Centre for Theoretical Physics, Trieste (Italy). Sep 1991. 8p. Order Number DE92615488. Source: OSTI; NTIS (US Sales Only); INIS.

Anomalous thermal behaviour on EPR linewidths has been observed for Gd impurities diluted in $CePd_3$-intermediate valent compound. In this work we show that the exchange interaction between the local magnetic moments and the intermediate valence host ions has an important contribution to the relaxation rates of the local moments. The relaxation is calculated using the Red-field formalism and the ideas contained in the interconfigurational fluctuation model of Hirst. We show that the exchange interaction contribution has an exponential dependence on the excitation energy of the intermediate valent ions. (author). 22 refs, 1 fig.

8176 (IC–91/288) **Monte Carlo simulation of the three-state vector Potts model on a three-dimensional random lattice.** Jianbo Zhang (International Centre for Theoretical Physics, Trieste (Italy)); Heping Ying. International Centre for Theoretical Physics, Trieste (Italy). Sep 1991. 12p. Order Number DE92615489. Source: OSTI; NTIS (US Sales Only); INIS.

We have performed a numerical simulation of the three-state vector Potts model on a three-dimensional random lattice. The averages of energy density, magnetization, specific heat and susceptibility of the system in the N^3(N=8,10,12) lattices were calculated. The results show that a first order nature of the Z(3) symmetry breaking transition appears, as characterized by a thermal hysterisis in the energy density as well as an abrupt drop of magnetization being sharper and discontinuous with increasing of volume in the cross-over region. The results obtained on the random lattice were consistent with those obtained on the three-dimensional cubic lattice. (author). 12 refs, 4 figs.

8177 (KEK–90-25(v.1), pp. 156-161) **Photons and neutrons.** Shirane, Gen (Brookhaven National Lab., Upton, NY (United States)). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

A review is given of two selected topics in current activities of synchrotron x-ray studies; magnetic x-ray scattering and inelastic x-ray scattering. These are the research areas where photons and neutrons directly compete and supplement each other. (author).

8178 (KEK–90-25(v.1), pp. 162-170) **Some thoughts on the future of neutron scattering.** Egelstaff, P.A. (Guelph Univ., ON (Canada). Dept. of Physics). National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Mar 1991. (CONF-9010243–: International collaboration on advanced neutron sources (ICANS), Tsukuba (Japan), 21-26 Oct 1990). In *Proceedings of the eleventh meeting of the international collaboration on advanced neutron sources (ICANS-XI).* 654p. Order Number DE92713960. Source: OSTI; NTIS (US Sales Only); INIS.

Attendance of ICANS meetings believe that neutron scattering has a bright future, but critics of neutron scattering argue that its practitioners are an aging group, that they use a few, very expensive neutron sources and that the interesting science may be done by other techniques. The ICANS committee asked me to comment on the future of neutron scattering in the light of this contrast. Some comments will be made on the age distribution, on the proper distribution of sources, on the convenient availability of neutron instruments and methods, on the expansion into new areas of science, on applications to industry and on the probable impact of synchrotron sources. It is hoped that these comments will lead to an outward looking discussion on the future. (author).

6652 Solid-State Plasma

8179 (IC–91/277) **Nonequilibrium statistical operator in hot-electron transport theory.** Xing, D.Y.; Liu, M. International Centre for Theoretical Physics, Trieste (Italy). Sep 1991. 22p. Order Number DE92615517. Source: OSTI; NTIS (US Sales Only); INIS.

The Nonequilibrium Statistical Operator method developed by Zubarev is generalized and applied to the study of hot-electron transport in semiconductors. The steady-state balance equations for momentum and energy are derived to the lowest order in the electron-lattice coupling. We show that the derived balance equations are exactly the same as those obtained by Lei and Ting. This equivalence stems from the fact that to the linear order in the electron-lattice coupling, two statistical density matrices have identical effect when they are used to calculate the average value of a dynamical operator. The application to the steady-state and transient hot-electron transport in multivalley semiconductors is also discussed. (author). 28 refs, 1 fig.

6653 Interactions Between Beams and Condensed Matter

Refer also to citation(s) 6993, 7026, 7239

8180 (BNL–46352) **Silicide formation in high-dose Fe-implanted silicon.** Tan, Z. (Brookhaven National Lab., Upton, NY (United States)); Heald, S.M.; Namavar, F.; Budnick, J.I.; Sanchez, F.H. Brookhaven National Lab., Upton, NY (United States). [1991]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016 ;FG02-90ER45424 ;AS05-80ER10742. (CONF-911202–23: Annual fall meeting of the Materials Research Society, Boston, MA (United States), 2-6 Dec 1991). Order Number DE92005376. Source: OSTI; NTIS; INIS; GPO Dep.

We have studied the silicide formation in Fe-implanted Si(100), with 1×10^{17}–1×10^{18} Fe/cm^2, using extended x-ray absorption fine structure (EXAFS), x-ray diffraction and Rutherford backscattering spectrometry (RBS) methods. In the samples as-implanted at 350°C, no silicide was observed at doses below 3×10^{17} Fe/cm^2. At 5×10^{17}, both α-FeSi$_2$ and β-FeSi$_2$ form but α-FeSi$_2$ appears to be the majority phase. As the dose increases to 7×10^{17} and above, ordered FeSi forms, but implantation damage is severe and a large number of Fe atoms are in very disordered environments. In addition to FeSi, Fe$_5$Si$_3$ was also observed in the 1×10^{18} Fe/cm^2 sample. Upon post-implantation annealing at 700°C or 900°C, single phase β-FeSi$_2$ was obtained independent of the dosage. 17 refs., 4 figs.

8181 (BNL–46717) **X-ray resonance magnetic scattering in EuAs$_3$.** Chattopadhyay, T. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)); Gruebel, G.; Axe, J.D.; Gibbs, D. Brookhaven National Lab., Upton, NY (United States). [1991]. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-910903–12: International conference on magnetism, Edinburgh (United Kingdom), 1-7 Sep 1991). Order Number DE92005003. Source: OSTI; NTIS; INIS; GPO Dep.

The magnetic properties of EuAs$_3$ have been investigated by X-ray magnetic scattering with synchrotron radiation. No magnetic scattering could be detected in EuAs$_3$ when the energy of X-rays was far away from the L absorption edges. Strong enhancement of magnetic intensities have been observed at the L$_{II}$ and L$_{III}$ absorption edges whereas no magnetic intensities could be detected at the L$_I$ absorption edge. The resonance enhancement at the L$_{III}$ absorption edge is stronger by a factor of about three compared to that the L$_{II}$ absorption edge. The magnetic properties of EuAs$_3$ determined previously by neutron scattering could be reproduced by resonance X-ray scattering.

8182 (BNL–46728) **Specular and diffuse x-ray scattering from surfaces and interfaces.** Sanyal, M.K. Brookhaven National Lab., Upton, NY (United States). [1991]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-911277–1: Solid state physics symposium, Bombay (India), 21-24 Dec 1991). Order Number DE92005010. Source: OSTI; NTIS; GPO Dep.

X-ray and neutron scattering studies of surfaces and interfaces have become increasingly popular over that last few year due to the recent developments in both scattering techniques and high intensity sources, particularly synchrotron x-ray sources. Although detailed characterization of any interface requires understanding of scattering both at small angles and in the (wide angle) Bragg reflection regime, as shall restrict ourselves here to discussing only the small angle region. Despite fundamental differences in the basic interactions between x-rays (or neutrons) with atoms, most of the analysis of our x-ray scattering results presented here can be used for neutron studies, with minor modifications. Although it should be mentioned here that current synchrotron x-ray sources are several orders of magnitude more intense than neutron sources and as a result for relatively smooth solid surface specular reflectivity can be measured down to 10^{-9} with x-rays where as for neutrons this value is $\sim 10^{-6}$ before the measured intensity is buried with diffuse scattering and other background. As we shall discuss, this reduces the resolution with which one can determine density profile at an interface. The plan of this talk is as follows. After giving a brief outline of this method, we shall discuss out results on liquid surfaces first, and then we shall analyze specular and diffuse scattering data of multilayer interfaces. Finally we demonstrate a new method of anomalous reflectivity to determine electron density profiles of thin films in a model independent way.

8183 (BNL–46822) **Resonant and non-resonant magnetic scattering.** McWhan, D.B.; Hastings, J.B.; Kao, C.C.; Siddons, D.P. Brookhaven National Lab., Upton, NY (United States). [1991]. 20p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-910730–26: 4. international conference on synchrotron radiation instrumentation, Chester (United Kingdom), 15-19 Jul 1991). Order Number DE92004985. Source: OSTI; NTIS; GPO Dep.

The tunability and the polarization of synchrotron radiation open upon new possibilities for the study of magnetism. Studies on magnetic materials performed at the National Synchrotron Light Source are reviewed, and thy fall into four areas: structure, evolution of magnetic order, separation of L and S, and resonance effects. In the vicinity of atomic absorption edges, the Faraday effect, magnetic circular dichroism, and resonant magnetic scattering are all related resonance effects which measure the spin polarized density of states. The production and analysis of polarized beams are discussed in the context of the study of magnetism with synchrotron radiation.

8184 (IC–91/172) **Dynamics of an exciton-carrier system in optically excited semiconductors.** Nguyen Ba An. International Centre for Theoretical Physics, Trieste (Italy). Jul 1991. 14p. Order Number DE92614558. Source: OSTI; NTIS (US Sales Only); INIS.

A set of nonlinear differential equations describing the dynamics of an exciton-photon-carrier system driven by two external classical laser fields is established taking into account the interaction between the quasiparticles as well as the screening of the photon-exciton transition due to the presence of definite exciton and carrier densities. It is shown that both stationary and transient behaviours of the system are considerably influenced by the densities. While the exciton-assisted photon-exciton transition may lead to optical tristability, it, together with the exciton-carrier interaction, modifies the parameter domains in which the phase trajectories form a limiting cycle, a torus or a strange attractor. The system dynamics thus can simply be controlled by adjusting the exciton or/ and the carrier densities which in turn depend on the level of the external optical pumpings. (author). 26 refs, 1 fig.

8185 (INIS-BR–2871) **Color centers as simultaneous active laser media and saturable absorbers.** Vieira Junior, N.D. (Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, SP (Brazil)); Assis, L.S.; Morato, S.P. Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, SP (Brazil). 1990 15p. Order Number DE92614559. Source: OSTI; NTIS (US Sales Only); INIS.

There is a family of color centers and metal ion doped crystals that absorb in the emission region of the neodimium lasers. These centers are in general laser active, being usually pumped in a collinear scheme. They can also be used as saturable absorbers for CW passive Q-switching, but this limits the maximum absorption that can be introduced in the laser cavity thus limiting the maximum gain achievable in the saturable absorber/active pumped medium. By using a coupled cavities scheme we were able to optimize the performance of the pumped medium and obtain CW Q-switched operation by an injection mechanism, being the saturable absorber the unique source of loss for the pump. We coupled an astigmatically compensated $KC1:T1^0(1)$ color center laser cavity with a Nd laser cavity using both properties of the $KC1:T1^0(1)$ crystal. We obtained complete Q switching of both lasers with a typical pulse width of one microsecond and a pumping efficiency of the color center laser in the order of 40% achieving a maximum output power of 1.3 watts for an input pump power of 3 W from the Nd;YAG laser. The Nd:YAG Q-switched operation was also tested in this coupled cavities scheme using $LiF:F_2^-$ color centers. The obtained pulse widths agree well with a simple theoretical model. (author).

8186 (INIS-mf–13026, pp. 303-304) **Heavy ion channeling in thin silicon single crystal.** Nanal, V.S. (Tata Inst. of Fundamental Research, Bombay (India)); Apte, P.R.; Kurup, M.B.; Prasad, K.G. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. CARBON 12 BEAMS/ion channeling; OXYGEN 16 BEAMS/ion channeling; SILICON/ion channeling; SILICON 28 BEAMS/ion channeling; ELASTIC SCATTERING; ETCHING; MEV RANGE 10-100; MONOCRYSTALS; PARTICLE PRODUCTION; SILICON; X RADIATION

8187 (INIS-mf–13071) **Ion beam synthesis of nitride layers in iron.** Vredenberg, A.M. Rijksuniversiteit Utrecht (Netherlands). 11 Jun 1991 96p. Order Number DE92614561. Source: OSTI; NTIS (US Sales Only); INIS.

This work was performed as part of the research program of the 'Stichting voor Fundamenteel Onderzoek der Materie FOM' (Foundation for Fundamental Research into Matter), with financial support from the 'Nederlandse Organisatie voor Wetenschappelijk Onderzoek WNO' (Netherlands Organization for Scientific Research), and the Program for Innovative Research of the Ministry for Economic Affairs (IOP-Metals). The work was performed in collaboration with the Division Physical Chemistry of the Solid State of the Laboratory of Materials Science of Delft University of Technology;includes summary in Dutch.

In this thesis a novel preparation technique for the fabrication of homogeneous single-phase nitride layers in iron is presented. This technique consists of a double implantation scheme. First a N (pre-) implantation, at an energy of a few hundred keV and at a low substrate temperature, is performed to nucleate nitride particles in the near-surface region. Then the specimen temperature is raised to 300 degree C and N is implanted at 1 MeV such that the N comes to rest in the Fe substrate at the back side of the preimplanted region. At this temperature N rapidly diffuses in the F matrix; hence, if it arrives at a pre-existing nitride particle, this is enabled to grow. closed γ'-Fe_4N layers result which grow at the substrate side for higher N fluences. Although these layers are buried under the surface, it is expected that by optimizing the implantation conditions, or even with a combination of implantation and thermochemical techniques, μm thick surface layers can be achieved. This thesis aims, first, to present a large body of experiments with the purpose of establishing the conditions under which nitride layers in Fe can be fabricated. Further, it addresses the role of phase formation, precipitation, phase transformation, diffusion, and beam-induced effects on the formation, growth and stability of γ' layers. Finally, it discusses these results in terms of the thermodynamics and kinetics of the experimentally identified processes. (author). 74 refs.; 33 figs.; 5 tabs.

8188 (INIS-SU–290, pp. 86-87) **Tritium diffusion in electrotechnical phosphorus with different degrees of radiative damage.** Eliseev, V.I. (Leningradskij Tekhnologicheskij Inst., Leningrad (USSR)); Puzhikin, D.Yu.; Gromov, L.A.; Semashko, N.N. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. 3 refs. PHOSPHORUS/physical radiation effects; TRITIUM/diffusion; HIGH TEMPERATURE; NEUTRON FLUENCE; PHOSPHORUS; TRITIUM; DIFFUSION; VERY HIGH TEMPERATURE

8189 (INIS-SU–290, pp. 87-88) **Diffusive model of frenkel defect formation during high energy particle transmission through crystal.** Entinzon, I.R. (AN Ukrainskoj SSR, Kiev (Ukrainian SSR)); Shevchenko, G.L. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433–: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. 3 refs. GERMANIUM/frenkel defects; GERMANIUM/physical radiation effects; SILICON/frenkel defects; SILICON/physical radiation effects; ATOM-ATOM COLLISIONS; CRYSTALS; ELECTRON BEAMS; GERMANIUM; KEV RANGE 100-1000; PROBABILITY; SILICON

8190 (INIS-SU–290, pp. 80-81) **Luminescence properties of alkali metal nitrates in pulsed radiation field.** Dolganov, V.S. (Kemerovskij Gosudarstvennyj Univ., Kemerovo (USSR)). AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe

Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433-: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. SODIUM NITRATES/luminescence; CRYSTALS; ELECTRON BEAMS; KINETICS; MEDIUM TEMPERATURE; PULSED IRRADIATION; LUMINESCENCE; VISIBLE RADIATION

8191 (INIS-SU-290, pp. 100-101) **Absorption spectra of glassy quartz under pulsed irradiation.** Zimina, G.M. (AN SSSR, Moscow (USSR). Inst. Ehlektrokhimii); Vannikov, A.V.; Zolotarevskij, V.I.; Titov, S.G.; Panteleeva, V.V.; Solinov, V.F. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433-: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. QUARTZ/absorption spectra; AMORPHOUS STATE; ELECTRON BEAMS; KINETICS; OPACITY; PHYSICAL RADIATION EFFECTS; PULSED IRRADIATION; QUARTZ

8192 (INIS-SU-290, pp. 109-110) **New approach to investigate paramagnetic radiative defect spatial distribution in disperse matter: F_s^+ centers in magnesium oxide with fraction texture.** Kutsovskij, Ya.E. (AN SSSR, Novosibirsk (USSR). Inst. Kataliza); Kurshev, V.V.; Aristov, A.M.; Rajtsimring, A.M.; Parmon, V.N. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR); AN SSSR, Moscow (USSR). Nauchnyj Sovet po Khimii Vysokikh Ehnergij; Nauchno-Issledovatel'skij Fiziko-Khimicheskij Inst., Moscow (USSR); AN SSSR, Moscow (USSR). Inst. Fizicheskoj Khimii; Vsesoyuznoe Khimicheskoe Obshchestvo, Moscow (USSR). 1990. 333p. (In Russian). (CONF-9010433-: 2. all-union conference on theoretical and applied radiation chemistry, Obninsk (USSR), 23-25 Oct 1990). In *2. All-union conference on theoretical and applied radiation chemistry: Summaries of reports.* Order Number DE92001320. Source: OSTI; NTIS (US Sales Only); INIS.

Short note. MAGNESIUM OXIDES/f centers; CRYSTALS; GAMMA RADIATION; KINETICS; PHYSICAL RADIATION EFFECTS; SPATIAL DISTRIBUTION; SPIN ECHO; SURFACES; TEXTURE

8193 (IS-T-1579) **The design, construction and applications of a novel double-axi helium atom spectrometer.** Folkerts, R. Ames Lab., IA (United States). 20 Dec 1991. 152p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. Order Number DE92005091. Source: OSTI; NTIS; INIS; GPO Dep.

A novel helium atoms spectrometer has been developed for the study of elastic and inelastic collisions with surfaces. The spectrometer is a double-axis design, providing the experimentalist with the capability of using an analyzer crystal to provide energy resolution for either elastic or inelastic experiments. The spectrometer in novel in that scattering angle at both axes may be adjusted during the experiment, allowing great flexibility in the design and execution of experiments of solid surfaces. The mechanisms and operating characteristics of the spectrometer are described. The initial tests of the spectrometer, using the well characterized LiF(001) surface, are also presented. These tests demonstrate that the spectrometer may function as a high precision double-axis diffractometer. During these initial tests, spurious scattering events and an insufficient signal to background ratio prevented the observation of single phonon scattering. Subsequent modifications to improve the signal to background are described.

8194 (LA-UR-91-3851) **Probing fine magnetic particles with neutron scattering.** Pynn, R. Los Alamos National Lab., NM (United States). [1991]. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-9111164-1: International workshop on studies of magnetic properties of fine particles and their relevance to materials science, Rome (Italy), 4-8 Nov 1991). Order Number DE92005018. Source: OSTI; NTIS; INIS; GPO Dep.

Because thermal neutrons are scattered both by nuclei and by unpaired electrons, they provide an ideal probe for studying the atomic and magnetic structures of fine-grained magnetic materials, including nanocrystalline solids, thin epitaxial layers, and colloidal suspensions of magnetic particles, known as ferrofluids. Diffraction, surface reflection, and small angle neutron scattering (SANS) are the techniques used. With the exception of surface reflection, these methods are described in this article. The combination of SANS with refractive-index matching and neutron polarisation analysis is particularly powerful because it allows the magnetic and atomic structures to be determined independently. This technique has been used to study both dilute and concentrated ferrofluid suspensions of relatively monodisperse cobalt particles, subjected to a series of applied magnetic fields. The size of the cobalt particle core and the surrounding surfactant layer were determined. The measured interparticle structure factor agrees well with a recent theory that allows correlations in binary mixtures of magnetic particles to be calculated in the case of complete magnetic alignment. When one of the species in such a binary mixture is a nonmagnetic, cyclindrical macromolecule, application of a magnetic field leads to some degree of alignment of the nonmagnetic species. This result has been demonstrated with tobacco mosaic virus suspended in a water-based ferrofluid.

8195 (SAND-91-1508C) **Simulations of low-energy ion bombardment and epitaxial growth.** Chason, E.; Bedrossian, P.; Tsao, J.Y.; Dodson, B.W.; Picraux, S.T. Sandia National Labs., Albuquerque, NM (United States). [1991]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC04-76DP00789. (CONF-911202-5: Annual fall meeting of the Materials Research Society, Boston, MA (United States), 2-6 Dec 1991). Order Number DE92004211. Source: OSTI; NTIS; INIS; GPO Dep.

We have performed computer simulations of epitaxial growth and low-energy ion bombardment for comparison with reflection high-energy electron diffraction (RHEED) measurements. The simulations are based on a hybrid Monte Carlo/rate equation approach which includes the processes of defect creation (adatom and surface vacancy), surface diffusion, and attachment and detachment from steps and islands. In this work, we focus on simulating the experimental observations of ion-induced RHEED oscillations and cancellation of RHEED oscillations during simultaneous ion bombardment and growth. For the interaction of the low-energy ion with the surface, we consider two mechanisms: preferential sputtering (where the sputtering cross section depends on the atomic coordination) and mobile vacancies. Our results indicate that the primary interaction of the ion beam with the surface is probably through the creation of mobile vacancies, and that the degree of preferential sputtering is not large.

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Refer also to citation(s) 6766, 6897, 6916, 6961, 6962, 6963, 6975, 7014, 7307, 7308, 7309, 7310, 7369, 7390

8196 (CNIC-00434) **Transportation properties of amorphous state InSb and its metastable middle phase.** Cao Xiaowen (Academia Sinica, Hefei, AH (China). Inst. of Plasma Physics). China Nuclear Information Centre, Beijing, BJ (China). Sep 1990. 17p. (In Chinese). (ASIPP-0019.). Order Number DE92614569. Source: OSTI; NTIS (US Sales Only); INIS.

The variation of the substrate temperature induces the metal-semiconductor transition in the condensation InSb films at low temperatrue. The electron conduction is dominant in the metal-type amorphous InSb and the hole in semiconductor-type one. In the metal-type amorphous InSb the electron-electron is correlated under the field above 0.1T in the temperature region of liquid nitrogen. The structure relaxation leads to not only the increase of the short range order but also the change of electron structure in metal-type amorphous InSb. The first conductance jump originates mainly from the increase of Hall mobility of the carrier, i.e. the increase of the short range order, and the system relaxes from the liquid-like to the lattice-like amorphous state. The three types of the crystallization phase transition for the metal-type amorphous InSb present obviously different transportation behaviours. Both metal-type amorphous state and metastable middle phase of InSb all are one of superconducting system with the lowest carrier concentration ($n_0 \approx 10^{18}$ cm^{-3}). Superconducting T_c of the metastable middle phase is related to the state density near Fermi surface, i.e. the higher T_c corresponds to the higher state density. The quasi-two-dimensional structure is favourable to superconductivity.

8197 (DOE/ER/14017–3) **Flux flow, pinning, and resistive behavior in superconducting networks: Final progress report, May 1, 1989–April 30, 1992.** Teitel, S. Rochester Univ., NY (United States). Dept. of Physics and Astronomy. Oct 1991. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-89ER14017. Order Number DE92004064. Source: OSTI; NTIS; INIS; GPO Dep.

We have studied the behavior of fluctuation effects in superconducting systems using numerical simulations of XY and Coulomb gas models. Flux flow resistance in two dimensional Josephson junction arrays has been calculated, and related to correlations in vortex structure. Randomness has been introduced, and its effects on the superconducting transition, and vortex mobility, have been studied. We find that randomness destroys phase coherence, yet the randomness induced pinning reduces flux flow resistance at low temperatures. Vortex line fluctuations in high temperature superconductors have been studied using a three dimensional XY model. We have considered the melting of the vortex line lattice, and the entanglement and cutting of vortex lines in the vortex line liquid phase. Vortex line entangling and cutting appear to occur on the same length scales in the liquid phase. The vortex structure function has been calculated and from it, elastic properties of the vortex line liquid have been inferred. The two dimensional classical Coulomb gas, where charges map onto vortices in the superconducting system, has been simulated. The melting transitions of ordered charge (vortex) lattices have been studied, and we find evidence that these transitions do not have the critical behavior expected from standard symmetry analysis.

8198 (FNAL-TM–1757) **End designs for superconducting magnets.** Bossert, R.C.; Cook, J.M.; Brandt, J.S. Fermi National Accelerator Lab., Batavia, IL (United States). Oct 1991. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-890872–16: Workshop on physics at Fermilab in the 1990's, Breckenridge, CO (United States), 15-24 Aug 1989). Order Number DE92003339. Source: OSTI; NTIS; INIS; GPO Dep.

New accelerators such as the Tevatron Upgrade frequently require higher magnetic fields that have been conventionally used in superconducting magnets. Modern magnet designs often have a smaller bore diameter and wider cable than the early (e.g., Tevatron) superconducting coils and are consequently harder to wind. These developments make consideration of end winding more important. End parts must be made to confine the conductors to a consistent shape. This shape must be defined and described to both the parts manufacturers and those analyzing the magnetic field. Internal stresses in the cable must be minimized. It has therefore become necessary to reevaluate the methods used to determine the configuration of a magnetic end. This note describes those methods and attempts to apply them to possible cross sections for high field dipoles. The original Tevatron dipole end configuration is reviewed for reference. 3 refs., 10 figs., 1 tab.

8199 (IC–91/217) **On the combination of the Cooper pair and the Ogg pair in the high-T_c oxide superconductor.** Zhang Liyuan. International Centre for Theoretical Physics, Trieste (Italy). Aug 1991. 12p. Order Number DE92614571. Source: OSTI; NTIS (US Sales Only); INIS.

In this paper it is argued that the superconductivity of the high-T_c oxide superconductor (HTOS) can be explained by the combinating mechanism of the Cooper pair and the Ogg pair. The properties of the superconducting state of the HTOS have been calculated under this mechanism, and the theoretical results are overall consistent with the experiment. (author). 37 refs.

8200 (IS-T–1577) **Phenomenological theory of electrodynamic properties of type-II superconductors.** Coffey, M.W. Ames Lab., IA (United States). 3 Jan 1992. 211p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. Order Number DE92005363. Source: OSTI; NTIS; INIS; GPO Dep.

The dissertation deals with certain electrodynamic properties of type-2 superconductors which are derived from phenomenological theory. For both discrete and continuous type-2 superconductors, vortex dynamics are investigated and their consequences described. Many of the results of the thesis are expected to apply to high-transition temperature superconductors. The subject of dimensional crossover in a layered anisotropic superconductor and its implications for vortex structure is discussed. For discrete superconductors, specific quantitative results include the viscous drag coefficient for vortex motion parallel to the layers of a Josephson-coupled layer model, the lower critical field for parallel applied field for such a model, and a vortex inertial mass for motion parallel to the layers. A self-consistent approach for describing the various fields and densities associated with a vortex lattice in a continuous superconductor subject to small-amplitude driving forces is developed. This approach takes into account the nonlocality of vortex interactions, yielding a complex penetration depth which in turn gives certain linear response functions such as the complex permeability. The resulting theory is expected to be valid over wide range of magnetic inductions, temperatures, and frequencies. The frequency- and temperature- dependent vortex mobility is developed, providing a unifying tool for describing vortex dynamics. By including a random force in the vortex equation of motion and treating it in analogy to Brownian motion, the vortex mobility is extended to include flux creep effects. For continuous superconductors, specific quantitative results are given for the vortex inertial mass and dynamic mobility and complex rf surface impedance and permeability. A description of energy dissipation and screening is given in terms of the rf surface impedance and permeability.

8201 (KAERI/RR–927/90) **A study on the development of high Tc superconducting materials and on the effects of neutron irradiation.** Won, Dong Yeon (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Chang, In Soon; Lee, Jong Min. Korean Standard Research Inst., Seoul (Korea, Republic of). Aug 1990. 98p. (In Korean). Order Number DE92615531. Source: OSTI; NTIS (US Sales Only); INIS.

An Ag-sheathed (Pb,Bi)SrCaCuO superconducting tape was prepared by the cold rolling and post heat treatment method. The tape shows a c-oriented texture perpendicular to the rolling direction. The aligned grain structure may be resulted from the anisotropic grain growth of the high Tc superconducting phase. The bulk (Pb,Bi)SrCaCuO samples with (a) Tc=10lK and (b) 96K were prepared by the solid state reaction method and were neutron-irradiated up to 1.5 x $10^{1}8$ n/cm^2. After irradiation the zero resistance temperature(Tc) of (a) was decreased to 96K but (b) did not show any change in Tc. The critical current density of (a) also decreased from 0.75A/cm^2 but (b) was constant as 1.5 A/cm^2 after irradiation. (Author).

8202 (KAERI/RR–940/90) **A study on the development of high Tc superconducting materials.** Won, Dong Yeon (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Chang, In Soon; Hong, Gye Won; Lee, Hee Gyoun; Kim, Chan Joong; Lee, Ho Jin; Park, Soon Dong; Kim, Woo Gon; Kim, Ki Baik; Kwon, Sun Chil. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1991. 58p. (In Korean). Order Number DE92615532. Source: OSTI; NTIS (US Sales Only); INIS.

High magnetization bulk YBaCuO superconductor was synthesized using Quasi-Melt-Process. The extent of magnetization was dependent on the composition of initial powder mixture, and the magnetization of $Y_1Ba_{1.8}Cu_3O_y$ and $Y_{1.2}Ba_{2.1}Cu_{3.1}O_x$ (123 + 10%211) was twice than that of $Y_lBa_{l.8}Cu_3O_y$. Anomalous double peak was observed in the M-H curve of $Y_1Ba_{1.8}Cu_3O_y$ and $Y_{l.2}Ba_{2.1}Cu_{3.1}O_x$ (123 + 10%211) specimen. YBaCuO superconducting thin film with a Tc of 81K has been prepared on (100) MgO single crystal substrate by CVD method. The crystallographic nature and R-T characteristics were hardly affected by the pressure change of reaction tube. However, the microstructure of the film was greatly affected: the film thickness increased three times when the pressure of the reaction tube was reduced from 20 to 5 torr. (Author).

8203 (KFK–4917) **Superconductivity in the homogeneous electron gas: Exchange and correlation effects.** Bueche, T. Kernforschungszentrum Karlsruhe GmbH (Germany). Inst. fuer Nukleare Festkoerperphysik; Karlsruhe Univ. (T.H.) (Germany). Fakultaet fuer Physik. Sep 1991. 117p. (In German). Order Number DE92759010. Source: OSTI; NTIS (US Sales Only); INIS.

We examine the influence of exchange and correlation effects on normal-state and superconducting properties of the homogeneous electron gas. Our investigations extend an earlier paper by Rietschel and Sham on exact solutions of Eliashberg's equations for the random-phase-approximation (RPA)-screened Coulomb interaction between the electrons. We do this in two steps: In a first step, the dielectric function is modified by including local-field corrections, while in a second step, the spin dependence of the electron-electron interaction is taken into account explicitly within a phenomenological model first proposed by Kukkonen and Overhauser. This latter step is synonymous with consideration of vertex corrections. Our main result is the following: Local-field corrections alone are not able to remove the artifact of plasmon-induced superconductivity in the RPA-screened electron gas as reflected by negative values for the Coulomb pseudopotential μ^*. Only additional consideration of spin-dependent vertex corrections leads to values for μ^* which are positive throughout and of order 0.05-0.1 for electronic densities $1 \leq r_S \leq 5$. In a last step we extend the formalism for μ^* to crystal electrons taking vanadium as example. (orig.).

8204 (LA-UR–91-3717) **Spin Singlet Quantum Hall Effect and nonabelian Landau-Ginzburg theory.** Balatsky, A. (Los Alamos National Lab., NM (United States)). Los Alamos National Lab., NM (United States). [1991]. 25p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract W-7405-ENG-36. (CONF-9108184–1: Adriatico conference on strongly correlated electrons, Trieste (Italy), Aug 1991). Order Number DE92003871. Source: OSTI; NTIS; INIS; GPO Dep.

In this paper we present a theory of Singlet Quantum Hall Effect (SQHE). We show that the Halperin-Haldane SQHE wave function can be written in the form of a product of a wave function for charged semions in a magnetic field and a wave function for the Chiral Spin Liquid of neutral spin-$\frac{1}{2}$ semions. We introduce field-theoretic model in which the electron operators are factorized in terms of charged spinless semions (holons) and neutral spin-$\frac{1}{2}$ semions (spinons). Broken time reversal symmetry and short ranged spin correlations lead to $Su(2)_{\kappa=1}$ Chern-Simons term in Landau-Ginzburg action for SQHE phase. We construct appropriate coherent states for SQHE phase and show the existence of SU(2) valued gauge potential. This potential appears as a result of "spin rigidity" of the ground state against any displacements of nodes of wave function from positions of the particles and reflects the nontrivial monodromy in the presence of these displacenmants. We argue that topological structure of $Su(2)_{\kappa=1}$ Chern-Simons theory unambiguously dictates semion statistics of spinons. 19 refs.

8205 (LBL–31157) **Suppression of magnetic flux noise in $YBa_2Cu_3O_{7-x}$ flux transformers.** Ferrari, M.; Wellstood, F.C.; Kingston, J.J.; Johnson, M.; Clarke, J. Lawrence Berkeley Lab., CA (United States). Aug 1991. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-9106224–2: 1991 superconducting quantum interference devices (IC SQUID) meeting, Berlin (Germany), 18-21 Jun 1991). Order Number DE92004306. Source: OSTI; NTIS; GPO Dep.

We have constructed hybrid magnetometers by coupling a flux transformer of $YBa_2Cu_3O_{7-x}$ to a Nb-PbIn SQUID. The low frequency (1/f) noise is dominated by fluctuations in the supercurrent circulating in the transformer, driven by vortex motion. The application of a small static magnetic field induces a supercurrent that reversibly suppresses the noise, in quantitative agreement with a model of thermally activated vortex hopping between symmetrical pairs of pinning sites. A persistent current can be used to reduce the low frequency noise power of high-$T_c$flux transformers by at least one order of magnitude. 11 refs., 4 figs., 1 tab.

8206 (LNS–160) **Neutron spectroscopic investigation of high temperature superconductors.** Allenspach, P. Eidgenoessische Technische Hochschule, Zuerich (Switzerland). Lab. fuer Neutronenstreuung. 1991. 152p. (In German). Order Number DE92615534. Source: OSTI; NTIS (US Sales Only); INIS.

In the high-temperature superconductors of the type $YBa_2Cu_3O_x$, $YBa_2Cu_4O_8$ and $YBa_2Cu_{3.5}O_{15}$ the Y-ion in between the superconducting planes can be substituted by most of the rare earth ions without changing the superconducting properties, whereas the electron superconductors Nd_2Cu and Pr_2CuO_4 alredy contain rare earth ion. The crystalline electric field of the plane oxygen and copper splits the (2J+1)-fold degeneracy of the magnetic ground state of the rare earth ion into different levels. This CEF-splitting can directly be measured by inelastic neutron scattering. Therefore the rare earth ion is a local probe of the structure and the charges in the superconducting planes. By varying sample parameters as oxygen stoichiometry or doping the CEF-splitting turned out to be very sensitive to structural and electronic changes. Taking into account both structure and CEF data quantitative results of the charge associated with doping or oxygen variation can be derived, if the quality of the data is sufficient. J-mixing and intermediate coupling had to be included in the analysis of the CEF-splitting of $Nd_{1+y}Ca_vBa_{2-y-v}Cu_{3+z}O_x$. A small decrease of the oxygen concentration turned out to induce a small amount of negative charge into the superconducting planes, whereas simultaneously T_c decreases very rapidly. Alreay 0.03 'e/plane oxygen' is needed. The origin of this behavior is the rather weak stability of $NdBa_2Cu_3O_x$ displayed as well in the tendency towards O5-occupation. Doping of additional Nd onto the Ba site or Ca yields additional negative or positive charge on the plane oxygen, respectively. CEF-calculations of the charge variation are consistent with the values obtained by other methods (e.g. Hall effect). (author) figs., tabs., 108 refs.

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8207 (INIS-BR–2865) **Introduction to controlled thermonuclear fusion.** Assis, A.S. de (Universidade Federal Fluminense, Niteroi, RJ (Brazil). Inst. de Fisica); Rapozo, C.C.; Paris, P.J.; Yasseen, F. Universidade Federal Fluminense, Niteroi, RJ (Brazil). Inst. de Fisica. Jul 1988 30p. (In Portuguese). Order Number DE92614431. Source: OSTI; NTIS (US Sales Only); INIS.

During many centuries the origin of the enormous power output of the sun remained as a mistery. However, in this century, the physicists have discovered that stars get their energy from the fusion of light nuclei (such as deuterons and tritons), and the Einstein's equation, $AE = (Am)c^2$, was the way to explain this physical process. (author).

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Refer also to citation(s) 6795, 7281, 8330, 8331, 8333, 8360, 8363, 8373

8208 (AMPC–031-046) **The optimization of production and control of hot-electron plasmas: Final technical report.** Dandl, R.A.; Guest, G.E. Applied Microwave Plasma Concepts, Inc., Carlsbad, CA (United States). 1 Oct 1991. 53p. Sponsored by U.S. DOE Energy Research. DOE Contract FG03-87ER53256. Order Number DE91019076. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the following topics: The generation rate of ECH triggered runaway electrons; space- and time-resolved measurements using free-free Bremsstrahlung; and wave propagation characteristics in the tokamak.

8209 (CNIC–00425) **Preliminary results in double cusp tandem mirror MM-4U.** Ming Linzhou (Southwest Inst. of Physics, Leshan, SC (China)); Tian Zhongyu; Feng Xiaozhen. China Nuclear Information Centre, Beijing, BJ (China). Oct 1990. 10p. (In Chinese). (SIP–0041.). Order Number DE92614432. Source: OSTI; NTIS (US Sales Only); INIS.

MM-4U device and preliminary experimental results are presented. Main results are as follows: The plasma has been produced by means of the injection of strong electron current; the axial profile of the plasma potential and the plasma electron density have been obtained respectively, they had a simular form; the plasma potential in the centre of the east cusp, the west cusp and the simple mirror; $V_e = -180V$, $V_w = -164V$, V_m -1.8V; the electron density: $n_e = 1.7 \times 10^{11}$ cm^{-3}, $n_w = 4.7 \times 10^{10}$ cm^{-3}, $n_m = 7.5 \times 10^7$ cm^{-3}; the electron temperature: $T_e = (19.9 \pm 1.6)$ eV, $T_w = (20.7 \pm 1.7)$ eV; the plasma pressure at 8 cm on the right of the west cusp centre is about 6.76 Pa, $\beta \simeq 1.7 \times 10^{-3}$. The plasma instability has been observed in the simple mirror, its vibration frequency was 7≈9.2 kHz. The results are discussed. The next new task of the physical experiment are proposed.

8210 (CTH-IEFT-PP–1991-09) **Effects of trapped alpha particles on internal kink modes in Tokamaks.** Helander, P.; Lisak, M. Chalmers Univ. of Tech., Goeteborg (Sweden). Inst. for Electromagnetic Field Theory and Plasma Physics. [1991]. 19p. Order Number DE92614462. Source: OSTI; NTIS (US Sales Only); INIS.

The theory of linear interaction between internal kink modes and fusion produced high-energy alpha particles in a toroidal plasma is extended by including finite banana width corrections to the alpha dynamics. An important implication of the theory for the stability properties of kink modes is that the finite banana width effects increase the values of the poloidal alpha beta which are required to attain the stable domain of operation as well as to excite the high-frequency fishbone instability. Furthermore, these effects provide a reduction of the instability growth rate in both the low and high frequency unstable regimes. (au).

8211 (CTH-IEFT-PP–1991-15) **Double beam free electron laser.** Wilhelmsson, H. (Laboratoire de Physique des Milieux Ionises, Ecole Polytechnique, Palaiseau (France)). Chalmers Univ. of Tech., Goeteborg (Sweden). Inst. for Electromagnetic Field Theory and Plasma Physics. [1991]. 8p. Order Number DE92614463. Source: OSTI; NTIS (US Sales Only); INIS.

Parametric interaction of longitudinal and transverse waves is studied for a double-beam system. The coupling between a transverse wave or a wiggler, and a longitudinal wave causes stimulated collective oscillations enhanced by double-stream amplification. These enhances oscillations are transformed by the wiggler into transverse waves and thus provide a source of radiation of the free electron laser. The analysis suggests new possibilities concerning free-electron laser operation. (au).

8212 (CTH-IEFT-PP–1991-16) **Nonlinear dynamics of reaction-diffusion systems: Analysis and computations.** Wilhelmsson, H. (Chalmers Univ. of Technology, Goeteborg (Sweden). Inst. of Electromagnetic Field Theory and Plasma Physics); Etlicher, B. Chalmers Univ. of Tech., Goeteborg (Sweden). Inst. for Electromagnetic Field Theory and Plasma Physics. [1991]. 26p. Order Number DE92614456. Source: OSTI; NTIS (US Sales Only); INIS.

Equilibria and dynamics of reaction-diffusion systems are studied by means of analysis and computations based on a central expansions method for radially symmetric as well as angularly asymmetric distributions. Effects of boundary conditions are included. The interplay between the different processes in the evolution of the system is considered. The investigation provides a unified description in one, two and three dimensions. A particular application concerns the time evolution of temperature profiles in a fusion reactor plasma. (au).

8213 (CTH-IEFT-PP–1991-17) **Evolution of temperature profiles in a fusion reactor plasma.** Wilhelmsson, H. (Chalmers Univ. of Technology, Goeteborg (Sweden). Inst. for Electromagnetic Field Theory and Plasma Physics); Etlicher, B.; Cairns, R.A.; Le Roux, M.N. Chalmers Univ. of Tech., Goeteborg (Sweden). Inst. for Electromagnetic Field Theory and Plasma Physics. [1991]. 16p. Order Number DE92614457. Source: OSTI; NTIS (US Sales Only); INIS.

The dynamics of plasma temperature profiles depends on the simultaneous processes of diffusion and creation, e.g. heating by alpha particles, as well as losses, e.g. bremsstrahlung, and furthermore on the effects of boundaries, which play an essential role in the formation of equilibria. The temperature evolution is governed by a partial differential equation of the reaction-diffusion type. The heating by alpha particles is represented by a source term which depends on temperature to a certain power. The present contribution summarizes the concepts and recent results of a new technique of analysis based on a central expansion in the spatial variable. The problem of studying the nonlinear partial differential equation governing the evolution of a temperature profile is transformed to a description in terms of three characteristic dynamic variables (amplitude, width and shape) which depend only on time and which are governed by three coupled first order differential equations. Such equations allow for dynamic description of self-organisation in open as well as bounded systems. The technique simplifies the description of the dynamic properties of the temperature evolution of a burning fusion plasma. It provides physical insight in the dynamics of the system by analysis of the interplay between the various simultaneous processes. In particular, the problems of existence, accessibility and approach to possible equilibria can be studied by means of the new technique.

8214 (CTH-IEFT-PP–1991-18) **Simultaneous diffusion, reaction and radiative loss processes in plasmas: Numerical analysis with application to the dynamics of a fusion reactor plasma.** Wilhelmsson, H. (Chalmers Univ. of Technology, Goeteborg (Sweden). Inst. for Electromagnetic Field Theory and Plasma Physics); Le Roux, M.N. Chalmers Univ. of Tech., Goeteborg (Sweden). Inst. for Electromagnetic Field Theory and Plasma Physics. [1991]. 19p. Order Number DE92614439. Source: OSTI; NTIS (US Sales Only); INIS.

Results are presented accounting for a selection of extensive numerical calculations of the evolution in space and time for a dynamic system, governed by a nonlinear diffusion equation with source and loss terms (which could also be nonlinear). The system is assumed to be circularly symmetric and limited by an external boundary where the value of the depending variable (e.g. temperature) is supposed to be zero. (au).

8215 (CTH-IEFT-PP–1991-19) **Energetic ion population formed in close collision with fusion alpha-particles.** Ryutov, D. (Institute of Nuclear Physics, Novosibirsk (USSR)). Chalmers Univ. of Tech., Goeteborg (Sweden). Inst. for Electromagnetic Field Theory and Plasma Physics. [1991]. 14p. Order Number DE92614458. Source: OSTI; NTIS (US Sales Only); INIS.

Close collisions of fusion alpha-particles with thermal plasma ions (both of impurities and of main component) give rise to formation of high energy 'halo' in the ion velocity space, extending to the energies of MeV-range even for rather heavy ions, like iron. The implications of this process for the diagnostics of the burning plasma have been discussed. There seem to be possible two versions of the diagnostics: * measurement of Doppler contours of the lines radiated by noncompletely stripped impurity ions, * detection of prompt losses of light impurities. In both versions the spatial resolution can be attained by injecting into the plasma the pellets containing the desired impurities. Another option is to detect the prompt losses of 7 MeV alpha-particles formed by collisions between 3.5 MeV alpha-particles. (au).

8216 (CTH-RF–76) **Data collection program for TANSY-KM5.** Grosshoeg, G. Chalmers Univ. of Tech., Goeteborg (Sweden). Dept. of Reactor Physics. 5 Jul 1991. 55p. Order Number DE92614442. Source: OSTI; NTIS (US Sales Only); INIS.

The purpose of the TANSY data collection program is dual. During normal measurement it fetches the incoming data, compresses them in a suitable shape and places the result in the CAMAC memory modules. The data should afterwards be taken care of by the JET Codas system. It may also be used as a stand-alone system. Calibrations can be done controlled by a terminal connected to the auxiliary CAMAC controller or by the host computer system. The program is written for the Starburst, the CES auxiliary CAMAC controller ACC 2180. It is essentially a PDP 11/70 computer on a microchip offering several advanced computer options. The program is written in assembler code in order to achieve shortest possible collection times. Some examples of user programs for the host are presented. They are written for RSX11/M operating system in a host Starburst. (au).

8217 (CTH-RF–81) **Technical description of the Tansy Spectrometer, TANSY-KM5.** Grosshoeg, G.; Aronsson, D.; Hoek, M.; Rydz, R.; Norberg, L.; Urholm, L. Chalmers Univ. of Tech., Goeteborg (Sweden). Dept. of Reactor Physics. Jul 1991. 37p. Order Number DE92614443. Source: OSTI; NTIS (US Sales Only); INIS.

The TANSY-KM5 neutron spectrometer is a system containing a lot of advanced electronic and mechanical components. The design of the system has been reported in two documents (CTH-RF–54 (INIS 17:10206) and CTH-RF–43 (INIS 14:797424)). The purpose of this documentation is to give a brief overview of the system as it is defined at the time of delivery.

8218 (CTH-RF–82) **User manual for TANSY-KM5.** Grosshoeg, G.; Aronsson, D.; Drozdowicz, K.; Hoek, M.; Rydz, R.; Norberg, L.; Urholm, L. Chalmers Univ. of Tech., Goeteborg (Sweden). Dept. of Reactor Physics. 3 Jul 1991. 41p. Order Number DE92614444. Source: OSTI; NTIS (US Sales Only); INIS.

This document describes procedures for the set-up and use of TANSY. It is a complement to the report 'Technical description of the Tansy Spectrometer, TANSY-KM5' (CTH-RF–81) and is aimed to guide the user through the initial adjustments and calibrations to a normal use of the instrument. Details, such as placing of jumpers and settings of potentiometers in electronic modules, are not given here. The calibration parameters obtained during the test period are listed at the end of each calibration chapter. They can be used as a first estimate of unknown parameters.

8219 (CTH-RF–83) **Fan-out module for TANSY-KM5.** Rydz, R.; Norberg, L.; Urholm, L.; Grosshoeg, G. Chalmers Univ. of Tech., Goeteborg (Sweden). Dept. of Reactor Physics. 1 Jul 1991. 20p. Order Number DE92614445. Source: OSTI; NTIS (US Sales Only); INIS.

The FAN-out module is a driver module for three time-to-digital units and one multiscaler unit. The 16 input signals come from the Ortec CO 1600 coincidence unit. Diagrams of the circuits and a component list for the module are given here.

8220 (CTH-RF–84) **Gate-keeper module for TANSY-KM5.** Rydz, R.; Norberg, L.; Urholm, L.; Grosshoeg, G. Chalmers Univ. of Tech., Goeteborg (Sweden). Dept. of Reactor Physics. 1 Jul 1991. 13p. Order Number DE92614446. Source: OSTI; NTIS (US Sales Only); INIS.

The purpose of the Gate-keeper is the control of the RDCs, the ADCs, and the constant fraction discriminator. The Gate-keeper synchronizes the units and ensures that the data taking is clean and not intermixed with other events. There are six Gate-Keepers in the system, one for each proton detector. All input circuits are designed to accept TTL as well as negative NIM signals. The output is 50 ohm TTL or negative NIM as defined by internal jumpers.

8221 (CTH-RF–85) **Control and evaluation programs for TANSY-KM5.** Grosshoeg, G.; Aronsson, D.; Hoek, M.; Rydz, R.; Norberg, L.; Urholm, L. Chalmers Univ. of Tech., Goeteborg (Sweden). Dept. of Reactor Physics. 4 Jul 1991. 32p. Order Number DE92614447. Source: OSTI; NTIS (US Sales Only); INIS.

Our first task was to purchase a computer and to create a basic software library for the preliminary test of the components. Our choice was a Starburst system from CES. The computer was a PDP-11/70 on a chip. It is the same computer as the ones used by the auxiliary CAMAC crate controllers in the TANSY system. However, the host has a 256 kbyte memory instead of the 64 kbyte memory used in the crate controllers. The operation system is RSX11-M. It is a real time system with properties suitable for laboratory works. However, the computer works in 64 kbyte partitions which limits the size of the programs. Four program systems were written. The two first were one-parameter systems for amplitude and time measurements using the ADCs and TDCs which later should be included in the TANSY system. These systems were supplemented with two two-parameter systems, one for time and amplitude measurements and one for time measurements on 16 detectors simultaneously. The display capabilities of these program systems have been used extensively by the TANSY programs. The programs needed for the manipulation of the system give the user a possibility to manually run the system without any intervention from the normal CODAS control system. The programs have been used for calibration measurements as well as test of the TANSY system. The evaluation programs use the output file from a normal measurement. The data file may be tested for errors. The true events can be sorted into different configurations. The final one is the neutron energy sort program, which gives the neutron energy distribution.

8222 (DOE/ER/53198–179) **Plasma physics research in the MST toroidal confinement device: Progress report, November 1, 1990–October 31, 1991.** Wisconsin Univ., Madison, WI (United States). [1991]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-85ER53198. Order Number DE92004056. Source: OSTI; NTIS; INIS; GPO Dep.

MST has matured in its operation to the point that substantial physics results are emerging. This paper contains accomplishments in FY 91 separated into physics results, diagnostic improvements, and machine improvements. In addition to achievements of the eight months which covers 11/1/91 to the present (7/15/91), we include the expected progress in the remaining four months of the grant period.

8223 (DOE/ER/53198–183) **Current density fluctuations and ambipolarity of transport.** Shen, W.; Dexter, R.N.; Prager, S.C. Wisconsin Univ., Madison, WI (United States). Oct 1991. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-85ER53198. Order Number DE92005231. Source: OSTI; NTIS; INIS; GPO Dep.

The fluctuation in the plasma current density is measured in the MIST reversed field pinch experiment. Such fluctuations, and the measured radial profile of the k spectrum of magnetic fluctuations, supports the view and that low frequency fluctuations ($f < 30$ kHz) are tearing modes and high frequency fluctuations (30 kHz $< f <$ 250 kHz) are localized turbulence in resonance with the local equilibrium magnetic field (i.e., $k \cdot B = 0$). Correlation of current density and magnetic fluctuations ($< \tilde{j}_{||}\tilde{B}_r >$) demonstrates that radial particle transport from particle motion parallel to a fluctuating magnetic field is ambipolar over the full frequency range.

8224 (DOE/ER/53198–184) **Turbulent transport in the MST reversed-field pinch.** Rempel, T.D.; Almagri, A.F.; Assadi, S.; Den Hartog, D.J.; Hokin, S.A.; Prager, S.C.; Sarff, J.S.; Shen, W.; Sidikman, K.L.; Spragins, C.W.; Sprott, J.C.; Stoneking, M.R.; Zita, E.J. Wisconsin Univ., Madison, WI (United States). Nov 1991. 27p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-85ER53198. (CONF-9111127–6: 33. annual Division of Plasma Physics/American Physical Society (DPP/APS) meeting, Tampa, FL (United States), 4-8 Nov 1991). Order Number DE92005230. Source: OSTI; NTIS; INIS; GPO Dep.

Measurements of edge turbulence and the associated transport are ongoing in the Madison Symmetric Torus ($R = 1.5$ m, $a = 0.52$ m) reversed-field pinch using magnetic and electrostatic probes. Magnetic fluctuations are dominated by $m = 1$ and $n \sim 2R/a$ tearing modes. Particle losses induced by magnetic field fluctuations have been found to be ambipolar ($<\tilde{J}_{parallel}\tilde{B}_r> = O$). Electrostatic fluctuations are broadband and turbulent, with mode widths $\delta m \sim$ 3–7 and $\delta n \sim$70–150. Particle, parallel current, and energy transport arising from coherent motion with the fluctuating $\tilde{E}xB$ drift has been measured. Particle transport via this channel is comparable to the total particle loss from MST. Energy transport (from $<\tilde{P}\tilde{E}_{phi}>/B_o$) due to electrostatic fluctuations is relatively small, and parallel current transport (from $<\tilde{J}_{parallel}\tilde{E}_{chi}>/B_o$) may be small as well.

8225 (DOE/ER/53198–185) **Ion heating and MHD dynamo fluctuations in the reversed field pinch.** Scime, E.; Hokin, S.; Watts, C.; Mattor, N. Wisconsin Univ., Madison, WI (United States). Jan 1992. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-85ER53198. Order Number DE92005229. Source: OSTI; NTIS; INIS; GPO Dep.

Ion temperature measurements, time resolved to 10 μs, have been made in the Madison Symmetric Torus reversed-field pinch with a five channel charge exchange analyzer. The ion temperature, $T_i \approx 200$ eV for $I = 350$ kA, increases by as much as 100% during discrete dynamo bursts in MST discharges. Magnetic field fluctuations in the range 0.5–5 MHz were also measured. Structure in the fluctuation frequency spectrum at the ion cyclotron frequency appears as the bursts terminate, suggesting that the mechanism of ion heating involves the dissipation of dynamo fluctuations at ion gyro-orbit scales.

8226 (DOE/ER/53211-10) **Advanced development of particle beam probe diagnostic systems: Technical progress report, October 1, 1990–December 15, 1991.** Hickok, R.L.; Crowley, T.P.; Connor, K.A.; Schoch, P.M. Rensselaer Polytechnic Inst., Troy, NY (United States). Dec 1991. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-85ER53211. Order Number DE92005299. Source: OSTI; NTIS; INIS; GPO Dep.

During the period covered by this report the 2 MeV heavy ion beam probe (HIBP) was installed on the TEXt tokamak. This report discusses the initial operating results of this probe.

8227 (DOE/ER/53212-178) **Theoretical reversed field pinch studies: Progress report, September 1, 1988–November 1, 1991.** Wisconsin Univ., Madison, WI (United States). [1991]. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-85ER53212 ;FG02-89ER53291 ;AC03-83ER53150 ;FG02-86ER53218. Order Number DE92004419. Source: OSTI; NTIS; GPO Dep.

This report discusses: nonlinear RFP behavior with nonideal boundaries; three dimensional RFP equilibria with field errors; self-consistent current density transport from microturbulence; turbulence studies in the RFP; coupled rippling and g-mode turbulence; microtearing turbulence; feedback of resistive wall instabilities; anomalous ion heating from the dynamo; effect of fluctuations on tearing instability; and thermal alfven wave fluctuations. (LSP)

8228 (DOE/ER/53214-3) **Spectroscopic diagnostics of high temperature plasmas, January 1, 1991–December 31, 1991.** Johns Hopkins Univ., Baltimore, MD (United States). [1991]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER53214. Order Number DE92005087. Source: OSTI; NTIS; INIS; GPO Dep.

During 1991, the activities of the John Hopkins University Plasma Spectroscopy Group have covered several areas of research, in the domain of XUV spectroscopy of magnetically confined fusion plasmas. While the main effort concentrated on the development of novel diagnostics which utilize Layered Synthetic Microstructures (LSMs) as the dispersive/filtering elements, work has been done in the area of detector development and the physics of the tokamak edge plasma. An XUV monochromator for the 20–200Å range, which uses flat LSMs, has been built and is currently operated on the D3-D tokamak at General Atomics in San Diego. A design for a follow-up experiment at D3-D is now in progress. As a preliminary step toward tokamak plasma imaging in the XUV wavelength range using curved LSM coated substrates, a prototype XUV camera was built and operated in our laboratory in image the A1 3 emission at λ-175Å from a Penning Ionization Discharge plasma. Based on these laboratory results, the design of the XUV camera, which will image plasma in the Phaedrus T tokamak O VI emission (150Å), has been completed. This instrument is presently under construction. Also a detailed design of a system composed of four LSM based imaging devices for $N_e(0)$ and $T_e(0)$ fluctuation measurements on TEXT has been completed. The accuracy and the uniformity of the LSM coatings on flat and small curved surfaces used in the above-mentioned instruments have been evaluated in our laboratory using an in-house built calibration facility and at the SURF II synchrotron at the National Institute of Standards and Technology.

8229 (DOE/ER/53218-17) **Magnetic confinement fusion plasma theory, Task 1: Final report, November 16, 1990–November 15, 1991.** Callen, J.D. Wisconsin Univ., Madison, WI (United States). Dept. of Nuclear Engineering and Engineering Physics. Jul 1991. 24p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER53218. Order Number DE91019077. Source: OSTI; NTIS; INIS; GPO Dep.

The research performed under this grant during the current year has concentrated on a few key tokamak plasma confinement and heating theory issues: extensive development of a new Chapman-Enskog-like fluid/kinetic hybrid approach to deriving rigorously valid fluid moment equations; applications (neoclassical viscous force, instabilities in the banana-plateau collisionality regime, nonlinear gyroviscous force, unified plasma microinstability equations and their implications, semi-collisional presheath modeling, etc.) of this new formalism; interactions of fluctuating bootstrap-current-driven magnetic islands; determination of net transport processes and equations for a tokamak; and some other topics (extracting more information from heat-pulse-propagation data, modeling of BES fluctuation data, exploring sawtooth effects on energy confinement in DIII-D, divertor X-point modeling). Recent progress and publications in these areas, and in the management of the local NERSC node and fusion theory DECstation 5000 at UW-Madison are summarized briefly in this report.

8230 (DOE/ER/53218-18) **Auxiliary radiofrequency heating of tokamaks, Task 3: Final report, November 16, 1988–November 15, 1991.** Scharer, J.E. Wisconsin Univ., Madison, WI (United States). Dept. of Electrical and Computer Engineering. Jul 1991. 21p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER53218. Order Number DE91019078. Source: OSTI; NTIS; INIS; GPO Dep.

The research performed under this grant during the past three years has been concentrated on the following several key tokamak ICRF (Ion Cyclotron Range of Frequencies) coupling and heating issues: efficient coupling during the L- to H-mode transition by analysis and computer simulation of ICRF antennas edge plasma profiles; analysis of both dielectric-filled waveguide and coil ICRF antenna coupling to plasma edge profiles; benchmarking the codes to compare with current JET, D-IIID and ASDEX experimental results; ICRF full-wave field solutions, power conservation and heating analyses; and the effects of fusion alpha particle or ion tail populations on the ICRF absorption. Research progress, publications, and conference and workshop presentations are summarized in this report. 15 refs.

8231 (DOE/ER/53218-19) **Transport Task Force Leadership, Task 4: Final report, November 16, 1990–November 15, 1991.** Callen, J.D. Wisconsin Univ., Madison, WI (United States). Dept. of Nuclear Engineering and Engineering Physics. Jul 1991. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER53218. Order Number DE91019082. Source: OSTI; NTIS; INIS; GPO Dep.

The Transport Task Force (TTF) was initiated as a broad-based US magnetic fusion community activity during the fall of 1988 to focus attention on and encourage development of an increased understanding of anomalous transport in tokamaks. The overall TTF goal is to make progress on Characterizing, Understanding and Identifying how to Reduce plasma transport in tokamaks – to CUIR transport.

8232 (DOE/ER/53269-4) **Methods for testing transport models: Second year annual report.** Singer, C.; Cox, D. Illinois Univ., Urbana, IL (United States). 14 Nov 1991. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER53269. Order Number DE92004489. Source: OSTI; NTIS; INIS; GPO Dep.

Substantial progress has been made over the past year on six aspects of the work supported by this grant. As a result, we have in hand for the first time a fairly complete set of transport models and improved statistical methods for testing them against large databases. We also have initial results of such tests. These results indicate that careful application of presently available transport theories can reasonably well produce a remarkably wide variety of tokamak data.

8233 (DOE/ET/53088-519) **1991 US-Japan workshop on Nuclear Fusion in Dense Plasmas: Proceedings.** Ichimaru, S. (ed.) (Tokyo Univ. (Japan). Dept. of Physics); Tajima, T. (ed.). Texas Univ., Austin, TX (United States). Inst. for Fusion Studies. Oct 1991. 67p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-80ET53088. (IFSR-519;CONF-9110119-: US-Japan workshop on nuclear fusion in dense plasmas, Austin, TX (United States), 7-9 Oct 1991). Order Number DE92004646. Source: OSTI; NTIS; INIS; GPO Dep.

The scientific areas covered at the Workshop may be classified into the following subfields: (1) basic theory of dense plasma physics and its interface with atomic physics and nuclear physics; (2) physics of dense z-pinches, ICF plasmas etc; (3) stellar interior plasmas; (4) cold fusion; and (5) other dense plasmas.

8234 (DOE/ET/53088-524) **Neoclassical diffusion in a turbulent plasma.** Yushmanov, P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst.

Atomnoj Ehnergii). Texas Univ., Austin, TX (United States). Inst. for Fusion Studies. Nov 1991. 22p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-80ET53088. (IFSR–524). Order Number DE92004248. Source: OSTI; NTIS; INIS; GPO Dep.

This work describes a new approach to plasma transport where the toroidal drift motion is considered as a perturbation to the fluctuating velocity. Percolation theory is used to determine the scaling of the diffusion coefficient. Several neoclassical phenomena should persist even when diffusion is enhanced from neoclassical predictions. Numerical simulation results support the theoretical scaling arguments.

8235 (DOE/ET/53088–525) **Self-consistent radial sheath in ignited plasmas.** Xiao, H. (Texas Univ., Austin, TX (United States)); Hazeltine, R.D.; Carrera, R. Texas Univ., Austin, TX (United States). Inst. for Fusion Studies. Nov 1991. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-80ET53088. (IFSR–525). Order Number DE92004251. Source: OSTI; NTIS; INIS; GPO Dep.

The radial sheath in ignited plasmas is studied based on the self-consistent effects of alpha particle's guiding-center orbits and E x B-induced toroidal rotation. The slowing-down alpha particle distribution determines the structure of the radial sheath through finite Larmor radius effects.

8236 (DOE/ET/53088–526) **Edge turbulence scaling with shear flow.** Zhang, Y.Z.; Mahajan, S.M. Texas Univ., Austin, TX (United States). Inst. for Fusion Studies. Nov 1991. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-80ET53088 ;FG05-88ER53266. (IFSR–526). Order Number DE92004249. Source: OSTI; NTIS; INIS; GPO Dep.

A formula relating turbulence levels with arbitrary shear flow is derived. When the diffusion coefficient is made a functional of the corresponding turbulence level, it is found that the scaling laws governing turbulence suppression are considerably modified. The results are compared with known formulas in various limiting cases, indicating that turbulence suppression mainly pertains in the moderate shear flow regime. The results also show that a flattened (steep) radial equilibrium gradient tends to enhance (eliminate) turbulence suppression due to the shear flow. 12 refs., 1 fig.

8237 (DOE/ET/53088–527) **Toroidal kinetic η_i-mode study in high temperature plasmas.** Dong, J.Q., Horton, W.; Kim, J.Y. Texas Univ., Austin, TX (United States). Inst. for Fusion Studies. Nov 1991. 32p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-80ET53088. (IFSR–527). Order Number DE92004252. Source: OSTI; NTIS; INIS; GPO Dep.

A new kinetic integral equation for the study of the ion temperature gradient driven mode in toroidal geometry is developed that includes the ion toroidal (curvature and magnetic gradient) drift motion ω_D, the mode coupling from finite $\kappa_{||}$ due to the toroidal feature of the sheared magnetic configuration. The integral equation allows the stability study for arbitrary $\kappa_{||}\ v_i/(\omega - \omega_D)$ and $\kappa\perp\rho_i$. A systematic parameter study is carried out for the low β circular flux surface equilibrium. Possible correlations between the unstable mode characteristics and some experimental results such as fluctuation spectrum and anomalous ion transport measurements are discussed.

8238 (DOE/ET/53088–531) **Existence and damping of toroidicity-induced Alfven eigenmodes.** Mahajan, S.M.; Mett, R.R. Texas Univ., Austin, TX (United States). Inst. for Fusion Studies. Dec 1991. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-80ET53088. (IFSR–531). Order Number DE92004250. Source: OSTI; NTIS; INIS; GPO Dep.

A new method of analyzing the toroidicity-induced Alfven eigenmode (TAE) from kinetic theory is presented. The analysis includes electron parallel dynamics non-perturbatively, an effect which is found to strongly influence the character and damping of the TAE – contrary to previous theoretical predictions. The normal electron Landau damping of the TAE is found to be higher than previously expected, and may explain recent experimental measurements of the TAE damping coefficient. 11 refs., 1 fig., 1 tab.

8239 (ENEA-RT-NUCL–90-04) **Contributions to 17th EPS conference on controlled fusion and plasma heating.** ENEA, Frascati (Italy). Area Nucleare. 1990. 60p. (CONF-900602–: 17. European Physical Society (EPS) conference on controlled fusion and plasma heating, Amsterdam (Netherlands), 25-29 Jun 1990; RT/NUCL–90-04). Order Number DE92743986. Source: OSTI; NTIS (US Sales Only).

From 17th EPS conference on controlled fusion and plasma heating; Amsterdam, Netherlands (25-29 Jun 1990).

In this report studies on controlled fusion and plasma heating are reported. The principal contributions are the following: long wavelength limit of temperature gradient mode in tokamak plasma; feasibility of diagnostics of JET LHCD plasma; propagation, absorption and particle dynamics of ion-Bernstein wave in tokamaks; plasma productions and conditions; plasma behaviour in FT Tokamak; modelling of interaction of energetic ions with lower hybrid waves on JET; production, power absorption, energy confinement in ASDEX; JET time of flight neutral particle analyser; energy confinement scaling laws for FT Ohmic plasma.

8240 (ENEA-RT-NUCL–90-04, pp. 9-12) **JET LHCD plasma diagnostics by means of x-ray crystal spectroscopy: Feasibility.** Bombarda, F.; Brusati, M.; Giannella, R.; Rimini, F. ENEA, Frascati (Italy). Area Nucleare. 1990. (CONF-900602–: 17. European Physical Society (EPS) conference on controlled fusion and plasma heating, Amsterdam (Netherlands), 25-29 Jun 1990). In *Contributions to 17th EPS conference on controlled fusion and plasma heating.* 60p. Order Number DE92743986. Source: OSTI; NTIS (US Sales Only).

From 17th EPS conference on controlled fusion and plasma heating; Amsterdam, Netherlands (25-29 Jun 1990).

The interaction of LH waves with JET (Joint European Torus) plasma is expected to develop a high energy tail in the electron distribution function. X-ray line emission from highly ionized impurities in the plasma can provide a means to measure the fractional density in the suprathermal electrons. The principle of this measurement, already successfully carried out on the FT tokamak, relies on the relative increase in brightness of a collisionally exited electric dipole transition, as for example, the resonance line of He-like ions, and on the observation that, for medium z ions, the impact cross section is fairly constant over the energy range of the fast electrons. In the paper, the applicability of this method for diagnosing suprathermal tails in JET plasma is discussed. The general conditions under which a measurement of the suprathermal component fractional density and its localization is expected to be feasible are defined. The set-up of the crystal spectrometers available at JET is outlined.

8241 (ENEA-RT-NUCL–90-04, pp. 57-60) **Energy confinement scaling laws for FT ohmic plasma.** Bracco, G.; Buratti, P.; Orsitto, F.; Santi, D. ENEA, Frascati (Italy). Area Nucleare. 1990. (CONF-900602–: 17. European Physical Society (EPS) conference on controlled fusion and plasma heating, Amsterdam (Netherlands), 25-29 Jun 1990). In *Contributions to 17th EPS conference on controlled fusion and plasma heating.* 60p. Order Number DE92743986. Source: OSTI; NTIS (US Sales Only).

From 17th EPS conference on controlled fusion and plasma heating; Amsterdam, Netherlands (25-29 Jun 1990).

This paper describes the development of a FT (Frascati tokamak) energy confinement data base which includes ohmic plasma results for magnetic fields in the range 2.5 to 10 T; line averaged density, from 1 to $30x10^{19}$m-3; q values, from 2.5 to 6.5; and for deuterium, hydrogen and helium working gases. The base data refers to plasma pulses of 1988-1989 operation. The paper considers only deuterium discharges which form the bulk of plasma pulses. The plasma major radius is 0.83 m, and minor radius is 0.20 m. The resulting global confinement time is compared with several standard scaling laws.

8242 (ENEA-RT-NUCL–90-04, pp. 49-52) **Power absorption and energy confinement during LH injection in ASDEX.** Bartiromo, R.; Leuterer, F.; Soldner, F.X.; Murmann, H.; Team, L.H. ENEA, Frascati (Italy). Area Nucleare. 1990. (CONF-900602–: 17. European Physical Society (EPS) conference on controlled fusion and plasma heating, Amsterdam (Netherlands), 25-29 Jun 1990). In *Contributions to 17th EPS conference on controlled fusion and plasma heating.* 60p. Order Number DE92743986. Source: OSTI; NTIS (US Sales Only).

From 17th EPS conference on controlled fusion and plasma heating; Amsterdam, Netherlands (25-29 Jun 1990).

Physical conditions which are not typical of usual tokamak operation can be realized by driving the plasma current with LH waves. The ohmic heating power can be reduced to zero together with the toroidal electric field. The temperature and current profile are not linked by Spitzer resistivity and the shape of these profiles can be varied by changing the current drive spectrum of the LH waves. It is therefore interesting to study the transport properties of the plasma in these conditions in order to gain some insight on the underlying physical mechanism. This paper reports on such a study on the tokamak Asdex which has already a solid data base on confinement for OH, NI and ICRH discharges. The radiofrequency system used in the experiment has been already described elsewhere. Here, attention is focussed on energy confinement. Particle transport is described in a companion paper at this conference.

8243 (ENEA-RT-NUCL–90-04, pp. 53-56) **JET time of flight neutral particle analyser.** Betello, G.; Bracco, G.; Moleti, A.; Tilia, B.; Zanza, V. ENEA, Frascati (Italy). Area Nucleare. 1990. (CONF-900602–: 17. European Physical Society (EPS) conference on controlled fusion and plasma heating, Amsterdam (Netherlands), 25-29 Jun 1990). In *Contributions to 17th EPS conference on controlled fusion and plasma heating.* 60p. Order Number DE92743986. Source: OSTI; NTIS (US Sales Only).

From 17th EPS conference on controlled fusion and plasma heating; Amsterdam, Netherlands (25-29 Jun 1990).

Neutral particle analysis provide a detailed measurement of the ion energy distribution function which can not be obtained by other diagnostics, together with information on neutral density. Standard neutral particle analysers have shown to be sensitive to the high neutron fluxex produced in the high temperature deuterium plasma of large tokamaks such as JET. The application of the coincidence technique can provide an effective way to discriminate the proper neutral signal from a random background. At the same time, it can be used to measure the particle time of flight. This paper describes the JET neutral particle analyser, with mass rejection capability and low random background sensitivity, which was developed and fully calibrated in the energy range between 0.5 and 200 KeV for hydrogen, deuterium and helium neutrals.

8244 (ENEA-RT-NUCL–90-04, pp. 45-48) **Impurity transport and production in lower hybrid discharges in ASDEX.** De Angelis, R. ENEA, Frascati (Italy). Area Nucleare. 1990. (CONF-900602–: 17. European Physical Society (EPS) conference on controlled fusion and plasma heating, Amsterdam (Netherlands), 25-29 Jun 1990). In *Contributions to 17th EPS conference on controlled fusion and plasma heating.* 60p. Order Number DE92743986. Source: OSTI; NTIS (US Sales Only).

From 17th EPS conference on controlled fusion and plasma heating; Amsterdam, Netherlands (25-29 Jun 1990).

During lower hybrid (LH) heating and current drive (CD) operation with ASDEX, an experiment was performed to determine how the wave injection affected impurity production in different base plasmas and coupling regimes. The study focussed on scaling with power and the wave spectrum, comparing other heating methods used on ASDEX, and assessing the possibility that the large number of fast electrons involved in the LH operation could have some influence on the impurity release from the wall. It was found that the impurity content during LH operation has an almost linear dependence on the total power given to the plasma. In the case of low density, current drive operation, the impurity signals resulted smaller than in ohmic discharges with equal input power. Finally, the large slide-away production observed in current driven plasmas at low LH power was not accompanied by an increase of impurity signals. From this observation, it was concluded that there is no significant impurity production concomitant with slide-away electron bombardment of the neutralizer plate or wall material.

8245 (ENEA-RT-NUCL–90-04, pp. 37-40) **Interaction of energetic ions with lower hybrid waves on JET: 1-D model.** Barbato, E. ENEA, Frascati (Italy). Area Nucleare. 1990. (CONF-900602–: 17. European Physical Society (EPS) conference on controlled fusion and plasma heating, Amsterdam (Netherlands), 25-29 Jun 1990). In *Contributions to 17th EPS conference on controlled fusion and plasma heating.* 60p. Order Number DE92743986. Source: OSTI; NTIS (US Sales Only).

From 17th EPS conference on controlled fusion and plasma heating; Amsterdam, Netherlands (25-29 Jun 1990).

Ion tails up to several MeV are generated and confined in the Jet plasma during ion cyclotron heating (ICRH) experiments. When injecting lower hybrid radiofrequency (LHRF) power at 3.7 GHz, such ions interact with LH waves limiting the current drive efficiency of the LH system. To study this problem a 1-D model (in the velocity space) for the wave-ions interaction was developed, includes, besides collisional diffusion and drag, the quasilinear LH and ICRF diffusion terms. To calculate the competition in the absorption between electrons and ions, this model was coupled to a deposition code for LH waves. In section 1 of this paper, the 1-D model and the deposition code are presented. Section 1 is devoted to the discussion of the numerical results. The study shows that the effect of LH waves on the ion distribution function (DF) (which remains mainly distorted by the ICRF waves) is to flatten the DF close to the resonant region. The temperature outside such region is dominated by the ICRF term.

8246 (ENEA-RT-NUCL–90-04, pp. 33-36) **Edge plasma behaviour: FT tokamak.** Pericoli Ridolfini, V. ENEA, Frascati (Italy). Area Nucleare. 1990. (CONF-900602–: 17. European Physical Society (EPS) conference on controlled fusion and plasma heating, Amsterdam (Netherlands), 25-29 Jun 1990). In *Contributions to 17th EPS conference on controlled fusion and plasma heating.* 60p. Order Number DE92743986. Source: OSTI; NTIS (US Sales Only).

From 17th EPS conference on controlled fusion and plasma heating; Amsterdam, Netherlands (25-29 Jun 1990).

With the FT tokamak it is possible to study the scrape-off lawer (SOL) plasma with densities and power flux densities which are higher, and therefore more reactore relevant, than in other tokamaks. That is of special importance due to the well established link between the SOL and the main plasma and for other key questions as the wall or limiter power loading and the impurity influx in a reactor. This study wants to give scaling laws for the principal SOL parameters, density and temperature at the limiter radius, of their e-folding lengths, and to describe the response of the SOL plasma to lower hybrid (LH) power injection.

8247 (ENEA-RT-NUCL–90-04, pp. 29-32) **Solitary vortex solution of nonlinear Eta$_i$-mode equations.** Hong, B.G.; Romanelli, F.; Ottaviani, M. ENEA, Frascati (Italy). Area Nucleare. 1990. (CONF-900602–: 17. European Physical Society (EPS) conference on controlled fusion and plasma heating, Amsterdam (Netherlands), 25-29 Jun 1990). In *Contributions to 17th EPS conference on controlled fusion and plasma heating.* 60p. Order Number DE92743986. Source: OSTI; NTIS (US Sales Only).

From 17th EPS conference on controlled fusion and plasma heating; Amsterdam, Netherlands (25-29 Jun 1990).

Drift wave instabilities driven to the ion temperature gradient Eta$_i$-mode play an important role in explaining anomalous transport in tokamak experiments. Several studies have been made in order to assess up to which extent the experimentally observed anomalous transport is correlated to the properties of turbolent drift wave spectra. In particular, recent 2-D numerical simulations of the Eta$_i$-mode show that long-lived, large scale coherent structures exist and considerably affect the level of magnitude of anomalous transport. A significant reduction of the turbolent heat flux with respect to the quasilinear estimate and positive dependence on dissipations is indeed observed. This work addresses the question whether the Eta$_i$-mode nonlinear equations admit such a coherent solution. In the cold ion limit and slab model, the nonlinear drift wave equation (Hasegawa-Mima equation) have stationary solitary vortex solutions. These solutions correspond to a coherent fluid motion with vanishing anomalous thermal flux.

8248 (ENEA-RT-NUCL–90-04, pp. 25-28) **Bulk ion temperature measurement on JET by means of collective scattering of gyrotron radiation: Feasibility studies.** Orsitto, F. ENEA, Frascati (Italy). Area Nucleare. 1990. (CONF-900602–: 17. European Physical Society (EPS) conference on controlled fusion and plasma heating, Amsterdam (Netherlands), 25-29 Jun 1990). In *Contributions to 17th EPS conference on controlled fusion and plasma heating.* 60p. Order Number DE92743986. Source: OSTI; NTIS (US Sales Only).

From 17th EPS conference on controlled fusion and plasma heating; Amsterdam, Netherlands (25-29 Jun 1990).

In the proposal for a Thomson scattering diagnostic of fast ions and alpha particles in JET, using a gyrotron (Lambda$_0$ = 0.214 cm), the possibility of measuring the plasma ion temperature was considered briefly, and a preliminary conclusion was that the signal-to-noise in this type of experiment should be large enough, provided plasma turbolence effects do not affect the spectrum. This report discusses the possibility of the measurement of the bulk ion feature in detail, because the proposed diagnostic could give detailed information on the ion dynamics through the measurement of the spatial ion temperature profile, possibly resolved in time. The predicted error on the ion temperature as measured by this diagnostic is of the order of 15%, the spatial resolution should be a few cm, and the temporal resolution is of the order of 10 ms. The recent results of the Lausanne collective scattering experiment give concrete support to these ideas, because the general understanding is that the theory at our disposal and the signal-to-noise ratio evaluation are in broad agreement with the experimental findings, at least in conditions in which strong refractive effects are not present.

8249 (ENEA-RT-NUCL–90-04, pp. 21-24) **Profile consistency coupled with MHD equilibrium extended to non-stationary plasma conditions.** Micozzi, P.; Roccella, M. ENEA, Frascati (Italy). Area Nucleare. 1990. (CONF-900602–: 17. European Physical Society (EPS) conference on controlled fusion and plasma heating, Amsterdam (Netherlands), 25-29 Jun 1990). In *Contributions to 17th EPS conference on controlled fusion and plasma heating.* 60p. Order Number DE92743986. Source: OSTI; NTIS (US Sales Only).

From 17th EPS conference on controlled fusion and plasma heating; Amsterdam, Netherlands (25-29 Jun 1990).

A profile consistency, based on the parallel component of the ohmic law coupled with MHD equilibrium, was need to obtain electron temperature profiles, both for stationary and non-stationary tokamak plasmas. The ohmic law contains a resistive neoclassical term and one term that accounts for the bootstrap current contribution. A numerical code was developed to solve the problem in which the equilibrium is solved using the toroidal multiple method. For stationary plasmas, temperature profiles close to the experimental data were obtained for a lot of machines very different in size, elongation, plasma current, toroidal field and density (JET, TFTR, Asdex, Alcator-A, Alcator-C and FT). Only some examples of the obtained fits are given in this report. The main feature of the model is the capability to provide a parametization of the ohmic law also in none stationary cases. In agreement with some experimental evidence, the model foresees a strong peaking of the temperature profile in non-stationary plasma only when the central value of q is decreasing in time.

8250 (ENEA-RT-NUCL–90-04, pp. 17-20) **Propagation absorption and particle dynamics of ion-Bernstein wave in tokamaks.** Cardinali, A.; Cesario, R.; De Marco, F. ENEA, Frascati (Italy). Area Nucleare. 1990. (CONF-900602–: 17. European Physical Society (EPS) conference on controlled fusion and plasma heating, Amsterdam (Netherlands), 25-29 Jun 1990). In *Contributions to 17th EPS conference on controlled fusion and plasma heating.* 60p. Order Number DE92743986. Source: OSTI; NTIS (US Sales Only).

From 17th EPS conference on controlled fusion and plasma heating; Amsterdam, Netherlands (25-29 Jun 1990).

Direct launch of ion Bernstein waves has been considered in these last years as an alternative method for heating directly the ions in the central region of tokamak plasma. Many experiments have been successfully performed, in particular, that of PLT and Alcator, where a large amount of power has coupled with a loop antenna to the plasma. The coupling characteristics of the waveguide antenna, to be used on the Frascati Tokamak Upgrade (FTU) at a frequency of 433 MHz, were discussed elsewhere. They are very similar to that of the lower hybrid wave coupling. For a plasma density typical of the FTU, and for the above mentioned frequency, the LH resonance layer is located inside but in the very edge of the plasma. Hence the mode transformation from electron plasma to ion Bernstein wave is expected to happen near the plasma edge and for very low density and temperature. In order to study the wave propagation and absorption of the IB mode, the complex dispersion equation is solved in the complex domain of the wave number in the slab geometry.

8251 (ENEA-RT-NUCL–90-04, pp. 13-16) **Parametric decay instabilities studies in Asdex.** Cardinali, A.; Cesario, R.; Paoletti, F.; Pericoli Ridolfini, V. ENEA, Frascati (Italy). Area Nucleare. 1990. (CONF-900602–: 17. European Physical Society (EPS) conference on controlled fusion and plasma heating, Amsterdam (Netherlands), 25-29 Jun 1990). In *Contributions to 17th EPS conference on controlled fusion and plasma heating.* 60p. Order Number DE92743986. Source: OSTI; NTIS (US Sales Only).

From 17th EPS conference on controlled fusion and plasma heating; Amsterdam, Netherlands (25-29 Jun 1990).

A search for some possible effects of parametric decay instabilities (PDI) on LH current drive and heating was conducted on Asdex through the analysis of the signal collected by a RF probe located in the scrape-off layer plasma. The frequency spectrum, whose shape is unaffected by the position of the probe, was characterized by two parameters: the width of 2.45 GHz pump line at -10db from maximum spectral broadening and the intensity of the first satellite, downshifted in frequency from the pump by one ion cyclotron frequency evaluated at the torus outer edge. The study indicated that a well defined threshold both of Plh and line averaged density exists for the onset of the first satellite. Its density first grows exponentially with Phl, then saturates. Before saturation it decreases considerably if either Ip or Bt are raised. The threshold power drops rapidly with line average density. The growth of these instabilities is determined by the conditions of the edge plasma, density and temperature, the coupled power and by the convective losses, determined in turn, by the grill dimensions.

8252 (ENEA-RT-NUCL–90-13) **Absorption of lower hybrid waves by fast ions.** Barbato, E. ENEA, Frascati (Italy). Dipt. Fusione. 1991. 11p. (RT/NUCL–90-13). Order Number DE92744004. Source: OSTI; NTIS (US Sales Only).

The LHCD (Lower Hybrid Current Drive) at 3.7 GHz experiment, scheduled to be carried out with the JET (Joint European Torus), will test the ability of LH waves to reach the central region of a high temperature elongated plasma and, at the same time, will show to which extent fast ions absorb the LH power. Ion tails up to few MeV are generated and confined in the JET plasma during Ion Cyclotron Heating (ICH) experiments. !ons of such energy can interact with LH waves at 3.7 GHz at the JET working density. These ions are located in the region where the IC wave (ICW) power is deposited. If the interaction between fast ions and LH waves occurs and is detectable, the LHW deposition profile could be studied, by varying the ICW deposition profile, and the absorption capability of fast ions could be analyzed, thus allowing extrapolation to future devices. With this aim, a Fokker-Planck (FP) 1-D model (in the velocity space) of the LHW-ion interaction is considered. It includes both the quasi-linear (QL) LHW and ICW diffusion terms. This model is coupled to a deposition code for LHW to study the competition in the absorption between ions and electrons. The maximum absorption capability by the minority ions is found by varying the plasma parameters, the minority concentration, and mass and the RF power levels.

8253 (ENEA-RT-NUCL–90-29) **Sawtooth repetition time scaling from reduced MHD simulations: Comparison with FT experiment.** Vlad, G.; Bracco, G.; Buratti, P. ENEA, Frascati (Italy). Area Nucleare. Sep 1991. 16p. (RT/NUCL–90-29). Order Number DE92744033. Source: OSTI; NTIS (US Sales Only).

The proposed scaling of the sawtooth repetition time for ohmic discharges was obtained by reduced magnetohydrodynamic (MHD) equation simulations together with a simple profile consistent transport model. The choice of a profile consistent perpendicular thermal diffusion coefficient allowed the obtaining of the scaling of the sawtooth repetition time in terms of the diffusion coefficients and edge safety factor (q_a), thus generalizing the scaling given by Vlad and Bondeson (Nucl. Fusion 29, 1139 (1989)). The scaling was in excellent agreement with the ohmic results of the Frascati Tokamak (FT).

8254 (ENEA-RT-NUCL–90-37) **Non-resonant electron velocity diffusion by lower hybrid waves in tokamaks.** Santini, F. ENEA, Frascati (Italy). Dipt. Fusione. Jun 1991. 24p. (RT/NUCL–90-37). Order Number DE92744009. Source: OSTI; NTIS (US Sales Only).

On the basis of the quasi-linear theory of tokamak current drive by lower hybrid waves, a velocity diffusion process is introduced for electrons that are not Landau resonating with the waves. This effect is connected to the time dependence of the wave field autocorrelations which can be determined by non-linear terms (only postulated here) or by the geometric effect of a sharp wave beam of finite toroidal width. In both cases, the role of non-resonant electron velocity diffusion is important in evaluating the driven current and the absorbed power correctly (as it may fill the gap in velocity space between bulk and resonant tail electrons). It also implies the presence of a fast REF-runaway electron tail above the Landau resonance. This tail requires a treatment which includes relativistic effects, as well as, 2-D velocity space and cross field transport of fast electrons, but preliminary considerations indicate that it does not depend much on the wave spectrum (or on the accessibility limit). Finally, the temperature scaling of the current drive efficiency is found to be different from the classical result obtained in the usual quasi-linear theory.

8255 (ENEA-RT-NUCL–90-39) **Tokamak plasmas: 1-D modelling.** Romanelli, F.; Nocentini, A. ENEA, Frascati (Italy). Area Nucleare. Jun 1991. 30p. (RT/NUCL–90-39). Order Number DE92744027. Source: OSTI; NTIS (US Sales Only).

An analysis is presented of a microinstability based model of anomalous transport which accounts for the effect of trapped electron dynamics and ion temperature gradients. A comparison with the experimental results obtained with the FT, TFTR and ASDEX tokamaks shows good agreement for the case of ohmic or moderate auxiliary heating; while in the case of strong auxiliary heating, results comparison shows that the convective part of the electron heat flux can be overestimated.

8256 (ENEA-RT-NUCL–90-40) **Analysis of satured ohmic confinement in FT tokamak.** Alladio, F.; Apruzzese, G.; Barbato, E.; Bardotti, G.; Bartiromo, R.; Berton, F.; Bombarda, F.; Bracco, G.; Briguglio, S.; Buceti, G. ENEA, Frascati (Italy). Dipt. Fusione. May 1991. 11p. (CONF-901025–48: 13. international conference on plasma physics and controlled nuclear fusion research, Washington, DC (United States), 1-6 Oct 1990; RT/NUCL–90-40). Order Number DE92744001. Source: OSTI; NTIS (US Sales Only).

From 13. International conference on plasma physics and controlled nuclear fusion research; Washington, USA (1-6 Oct 1990).

The energy confinement time for ohmically heated discharges in the FT (Frascati, Italy) tokamak was studied in a wide range of plasma parameters. It was found to increase linearly with the line averaged density below a value of $1x10^{14}$ per cubic centimeter and to saturate at higher densities. Analysis of the experimental data showed that, at the same density at which saturation was reached, the effective charge state became nearly equal to 1, and the electron and ion temperatures became nearly equal. The saturated energy confinement time showed a strong isotope effect with a reduction factor of 1.5 when operating in hydrogen. The sawtooth period was closely correlated with energy confinement time and displayed the same saturated behaviour and isotope effect. The ion thermal diffusivity was found to be compatible with neoclassical theory up to the maximum density, but a neoclassical multiplier of 3 would only fit the highest line averaged density data. The electron thermal diffusivity first decreased with the inverse of line averaged density, but remained nearly constant in the saturated region. Therefore, ohmic saturation in the FT seems to be primarily caused by electron transport.

8257 (GA-A–20610) **Displaying DIII-D plasma data using DEC's X window system.** Greene, K.L. General Atomics, San Diego, CA (United States). Nov 1991. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-89ER51114. (CONF-910968–54: 14. IEEE symposium on fusion engineering, San Diego, CA (United States), 30 Sep - 3 oct 1991). Order Number DE92004456. Source: OSTI; NTIS; INIS; GPO Dep.

The D3-D tokamak program, funded by the Department of Energy, carries out plasma physics and fusion energy research experiments. The machine began operation in February 1986; at that time, approximately 7 Mbytes of data was collected for shot. Since that time, the shot size has steadily increased to over 50 Mbytes with the average shot size between 35 and 45 Mbytes. Shots are fired every 12 to 15 minutes and last approximately 5 to 10 seconds. Between 30 and 40 shots are fired each day when plasma experiments are scheduled. In 1987 MFITD and MFITPLAY were written/modified. These two programs provide graphical output that allows the users to see, before the next shot, the plasma shape and the locations of the plasma and magnetic flux lines within the tokamak. MFITD performs the computations which calculate the shape and location of the plasma; it also graphically displays a small subset of timeslice data. MFITPLAY graphically displays the full set of timeslice data. Through interactive commands, MFITPLAY also allows the user to control the various aspects of how the data is displayed. In 1990, both programs were converted from User Interface Services (UIS) routines, which are part of the MicroVMS workstation graphics software, to DEC's X Window System using the DECWindows window manager. These modifications were required because of a move by Digital Equipment Corporation (DEC) to support X windows and phase out UIS. Due to the nature and purpose of each program, MFITD needed only simple graphics conversion while MFITPLAY was completely rewritten. The DECWindows version of MFITPLAY offers a number of improvements, such as a more intuitive user interface.

8258 (GA-A–20619) **30-60 MHz FWCD system on DIII-D: Power division, phase control and tuning for a four-element antenna array.** Pinsker, R.I. (General Atomics, San Diego, CA (United States)); Mayberry, M.J.; Petty, C.C.; Cary, W.P.; Pusl, J.; Remsen, D.; Baity, F.W.; Goulding, R.H.; Hofmann, D.J. General Atomics, San Diego, CA (United States). Nov 1991. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-89ER51114. (CONF-910968–51: 14. IEEE symposium on fusion engineering, San Diego, CA (United States), 30 Sep - 3 oct 1991). Order Number DE92004294. Source: OSTI; NTIS; INIS; GPO Dep.

The 2 MW Fast Wave Current Drive system on DIII-D is intended to provide a near-term demonstration of up to 0.3 MA of current driven by the fast wave. The system used to drive the four element phased antenna array which produces the required directional spectrum is presented. This system must be able to cope with strong coupling between antenna elements and the time-varying plasma load seen by the antennas. Computer modelling shows that this system should be able to maintain a directional spectrum at full power under most anticipated load conditions. 5 refs., 1 fig.

8259 (IAEA-TECDOC–604, pp. 23-27) **External helical coil studies on Tokoloshe tokamak.** Villiers, J.A.M. de (Atomic Energy Corp. of South Africa Ltd., Pretoria (South Africa)); Fletcher, J.D.; Nothnagel, G.; Roberts, D.E.; Sherwell, D. International Atomic Energy Agency, Vienna (Austria). May 1991. (CONF-9009463–: Technical committee on research using small tokamaks, Arlington, VA (United States), 27 Sep 1990). In *Research using small tokamaks: Proceedings of a technical committee meeting held in Arlington, Virginia, USA, 27-28 September 1990.* 198p. Order Number DE92615416. Source: OSTI; NTIS (US Sales Only); INIS.

Tokoloshe is a low aspect ratio tokamak (R/a=0.52m/0.24m) with a maximum possible toroidal field of 1.2 T. Due to the low aspect ratio, peak plasma currents of I_p < or approx. 150 kA can be obtained at $B_\phi \simeq 0.6$ T. The discharge duration is typically < or approx. 40 ms when it is terminated by a major disruption due to strong gas puffing. Line average densities generally reach peak values of around $6x10^{13}cm^{-3}$. Central electron temperatures range from 550 eV early in the discharge to about 350 eV just before the disruption with a typical $Z_{eff} \simeq 2$. The machine is fitted with 4 sets of windings for detailed studies of the stability and confinement of tokamak plasmas. The work originally started with a pure poloidal winding (l=m/n=0/1) within the limiter. Pulses yielding a maximum axial perturbation of the toroidal field of ±8.5% were possible. Subsequently, 3 sets of stellarator type helical windings (l=1,2 and 3) were fitted on the outside of the vacuum chamber. These conformed to a general winding law of ϕ=m/n(θ-$\delta_{m/n}$sinθ) (with $\delta_{m/n}$=40, 48 and 0 degrees respectively for l=m/n=1/1,2/1 and 3/1) except for local deviations around ports and major protrusions. The δ-values were chosen initially to minimize contributions to m/n=3/1 islands. Subsequent comparison of the calculated mode spectra with those derived from vacuum field measurements confirmed the design expectations. In practice these 3 sets of windings can be driven individually or in pairs with peak current pulses of approximately 9, 6 and 5 kA respectively. The pulse rise times are about 1 ms and pulse widths are adjustable from a few ms to 10 ms or more with a falling amplitude due to resistive decay. (author). 7 refs, 5 figs.

8260 (IAEA-TECDOC–604, pp. 79-84) **Transport phenomena in pellet injection experiments on JIPP T-IIU tokamak.** Ogawa, Y. (National Inst. for Fusion Science, Nagoya (Japan)); Sakamoto, M.; Sato, K.N.; Kawahata, K.; Hirokura, S.; Okajima, S. JIPP T-IIU Group. International Atomic Energy Agency, Vienna (Austria). May 1991. (CONF-9009463–: Technical committee on research using small tokamaks, Arlington, VA (United States), 27 Sep 1990). In *Research using small tokamaks: Proceedings of a technical committee meeting held in Arlington, Virginia, USA, 27-28 September 1990.* 198p. Order Number DE92615416. Source: OSTI; NTIS (US Sales Only); INIS.

Transport phenomena associated with pellet injection have been intensively studied on JIPP T-IIU tokamak. When a large pellet has been injected, marked peaking of the density profile has been observed just after the hollow density profile produced by the pellet injection. This marked inward pinch of the density might suggest some instability associated with an ηi mode, since density fluctuations on the ion mode has been simultaneously observed in FIR scattering. By injecting a small pellet as a source of a density perturbation, the particle diffusion has been analyzed, and diffusion coefficients and inward pinch velocity have been derived with 1-D transport code. Next, we have studied the ultra fast cooling phenomenon (so-called pre-cooling) at the pellet ablation phase, where the propagation speed of the cooling front is extremely faster than the pellet injection speed. This pre-cooling phenomenon has been confirmed with two independent diagnostics (ECE and Soft-X-ray). The density around the plasma center has never increased during this pre-cooling, contrary to the clear decrease of the electron temperature. (author). 6 refs, 7 figs.

8261 (IAEA-TECDOC–604, pp. 85-91) **Evaluation of absolute impurity ion densities in tokamak edge plasmas by means of lithium beam-activated charge exchange spectroscopy (Li-CXS).** Aumayr, F. (Technische Univ., Vienna (Austria). Inst. fuer Allgemeine Physik); Unterreiter, E.; Winter, H.P. International Atomic Energy Agency, Vienna (Austria). May 1991. (CONF-9009463–: Technical committee on research using small tokamaks, Arlington, VA (United States), 27 Sep 1990). In *Research using small tokamaks: Proceedings of a technical committee meeting held in Arlington, Virginia, USA, 27-28 September 1990.* 198p. Order Number DE92615416. Source: OSTI; NTIS (US Sales Only); INIS.

Impurity ion concentrations in the edge plasma of tokamak discharges can be determined with excellent spatial and temporal resolution by means of lithium beam-activated charge exchange spectroscopy (Li-CXS), i.e. by utilizing electron capture from injected fast Li atoms into excited states of the impurity ions of interest, and spectroscopic observation of the resulting characteristic impurity ion line emission. First demonstration measurements of the new diagnostic method are being presented. Furthermore, we discuss important aspects regarding the practical use of Li-CXS to achieve precise information on impurity ion concentrations in tokamak edge plasmas. (1) Attenuation of the injected lithium beam has to be taken precisely taking into account. For this purpose we have developed an attenuation code which includes the excitation, deexcitation and ionisation of injected Li atoms via collisions with electrons and protons in the edge plasma environment. The attenuation can be calculated for different numbers of excited LiI states. (2) After their population by electron capture from Li, some of the resulting excited impurity ion states may become mixed due to collisions with plasma particles before radiating. Consequently, the relation between impurity ion density and characteristic line radiation intensity can deviate considerably from the one derived in experiments involving single collisions between the impurity ions of interest and Li ground state atoms. Attenuation calculations have been carried out to first evaluate measurements of C^{5+} and C^{6+} concentrations in the edge plasma of TEXTOR ohmical discharges (KFA Juelich, Germany), as will be demonstrated in the present report. Regarding the actual importance of excited level mixing, specific experiments are needed to compare our calculations with measured distributions of charge exchange-excited impurity ion states produced within typical tokamak edge plasmas. (author). 9 refs, 8 figs.

8262 (IAEA-TECDOC–604, pp. 47-60) **Energy confinement and coupling of transport process with MHD modes.** Zhang Cheng (Academia Sinica, Hefei, AH (China). Inst. of Plasma Physics); Duen Baohua; Yu Guoyang; Huo Yuping. International Atomic Energy Agency, Vienna (Austria). May 1991. (CONF-9009463–: Technical committee on research using small tokamaks, Arlington, VA (United States), 27 Sep 1990). In *Research using small tokamaks: Proceedings of a technical committee meeting held in Arlington, Virginia, USA, 27-28 September 1990.* 198p. Order Number DE92615416. Source: OSTI; NTIS (US Sales Only); INIS.

Starting from Tearing Mode equation, the growth rate equations of magnetic islands, the energy and particle balance equations with large effective thermoconductivity and diffusion in magnetic islands, it has been shown that the width of magnetic islands of different tearing modes and the temperature profile all oscillate with time. In some cases the oscillation frequency is the same as of the sawteeth, but in other cases it is in the range of observed Mirnov oscillations. From these equations we have calculated the energy confinement time of the plasma, and compared it with the confinement time purely due to the anomalous thermoconductivity in $q > 1$ region. The scaling laws of these two kinds of confinement time are quite different. This result shows clearly that it is impermissible to compare the experimental results directly with anomalous transport analysis, as usually done before. (author). 8 figs, 1 tab.

8263 (IAEA-TECDOC–604, pp. 61-78) **Simulation of turbulent plasma heating by the ion-ion instability and ICRH through resonant absorption in two-ion species plasma.** Demchenko, V. (International Atomic Energy Agency, Vienna (Austria). Dept. of Research and Isotopes). International Atomic Energy Agency, Vienna (Austria). May 1991. (CONF-9009463–: Technical committee on research using small tokamaks, Arlington, VA (United States), 27 Sep 1990). In *Research using small tokamaks: Proceedings of a technical committee meeting held in Arlington, Virginia, USA, 27-28 September 1990.* 198p. Order Number DE92615416. Source: OSTI; NTIS (US Sales Only); INIS.

Numerical simulation of current instability development and saturation in a plasma with two ion species under the relative motion of ion components transverse to the strong magnetic field are discussed. It is shown that saturation of ion-ion current instability is of strong turbulent nature. This fact is based on the generation in configuration space of non-stationary density holes (cavitons) and regular structures (vortexies) in space phase. Resonant interaction of ions with plasma waves trapped into the cavity leads to the destruction of regular structures and to the stochastic (turbulent) plasma heating. Particle simulation of two-ion hybrid cyclotron resonance heating of a magnetized hydrogen plasma with deuteron minority of FMSW launched from the low magnetic field side is presented. Depending on the minority concentration, partial transmission and partial reflection of the incoming waves off the two-ion hybrid resonance layer occur, in contrast to the mode conversion mainly taking place during incidence from the high field side. Preferential minority heating is observed, as the minority cyclotron resonance is close to the two-ion hybrid resonance layer. (author). 21 refs, figs.

8264 (IAEA-TECDOC–604, pp. 97-101) **Control of tokamak edge fluctuations.** Singh, R. (Institute for Plasma Research, Bhat, Gandhinagar (India)); Kaw, P.K.; Sen, A.; Deshpande, S.; Sen, A.K. International Atomic Energy Agency, Vienna (Austria). May 1991. (CONF-9009463–: Technical committee on research using small tokamaks, Arlington, VA (United States), 27 Sep 1990). In

Research using small tokamaks: Proceedings of a technical committee meeting held in Arlington, Virginia, USA, 27-28 September 1990. 198p. Order Number DE92615416. Source: OSTI; NTIS (US Sales Only); INIS.

This paper deals with two attractive methods which have been proposed for the control of edge fluctuations in a tokamak plasma, viz., (i) active feedback stabilization; and (ii) introduction of sheared poloidal flow. Eigenmode equations for the rippling mode, the drift-dissipative mode and the radiative condensation instability in the presence of a sheared poloidal flow and a phase sensitive feedback source have been set up and analytically solved in some limiting cases. Conditions for stabilization of the above mentioned instabilities are discussed. (author). 8 refs.

8265 (IAEA-TECDOC–604, pp. 29-33) **Discrete Alfven waves in TORTUS.** Ballico, M.J. (Sydney Univ., New South Wales (Australia). Wills Plasma Physics Dept.); Bowden, M.; Brennan, M.H.; Cross, R.C.; James, B.W. International Atomic Energy Agency, Vienna (Austria). May 1991. (CONF-9009463–: Technical committee on research using small tokamaks, Arlington, VA (United States), 27 Sep 1990). In *Research using small tokamaks: Proceedings of a technical committee meeting held in Arlington, Virginia, USA, 27-28 September 1990.* 198p. Order Number DE92615416. Source: OSTI; NTIS (US Sales Only); INIS.

Observations are presented of discrete Alfven waves in the TORTUS tokamak. The results are interpreted in terms of the measured density profiles and an inferred central q. (author). 5 refs, 2 figs.

8266 (IAEA-TECDOC–604, pp. 41-45) **The m=2 tearing mode in TEXT.** Chen, J.Y. (Academia Sinica, Hefei, AH (China). Inst. of Plasma Physics); McCool, S.C.; Wootton, A.J. International Atomic Energy Agency, Vienna (Austria). May 1991. Grant DE-FG05-88ER-53267. (CONF-9009463–: Technical committee on research using small tokamaks, Arlington, VA (United States), 27 Sep 1990). In *Research using small tokamaks: Proceedings of a technical committee meeting held in Arlington, Virginia, USA, 27-28 September 1990.* 198p. Order Number DE92615416. Source: OSTI; NTIS (US Sales Only); INIS.

In TEXT an m=2 island is seen to grow linearly in time for a wide range of island widths before it saturates. This is consistent with the Rutherford regime and implies a weak dependence of Δ' on the island width. Both experimental and numerical results show q(0) is an important parameter in the mode evolution. The frequency of the mode changes significantly during the Rutherford growth. The scaling of frequency versus island width and machine size agree with a neoclassical poloidal rotation model. The enhanced particle transport observed is consistent with edge magnetic island transport produced by the Ergodic Magnetic Limiter but an order higher than that predicted by stochastic transport mechanisms. (author). 8 refs, 5 figs.

8267 (IAEA-TECDOC–604, pp. 11-22) **The use of ECRH, LHCD and resonant helical fields to influence tokamak instabilities.** Morris, A.W. (Euratom-UKAEA Fusion Association, Abingdon (United Kingdom). Culham Lab.). International Atomic Energy Agency, Vienna (Austria). May 1991. (CONF-9009463–: Technical committee on research using small tokamaks, Arlington, VA (United States), 27 Sep 1990). In *Research using small tokamaks: Proceedings of a technical committee meeting held in Arlington, Virginia, USA, 27-28 September 1990.* 198p. Order Number DE92615416. Source: OSTI; NTIS (US Sales Only); INIS.

The control of MHD instabilities and disruptions remains a problem for future tokamaks, and a number of experiments have been performed on the DITE and COMPASS-C tokamaks to develop control techniques. A variety of tools are available on these devices: LHCD, ECRH, and external resonant magnetic perturbations (RMP) inside and outside the vessels. The last two have been operated in fast feedback loops following rotating instabilities, as well as quasi-DC. Suppression of density limit disruptions with magnetic feedback has been demonstrated, as well as control of internal modes (m=1, n=1 and the sawtooth) using RF or magnetic feedback techniques. An extensive study of the effect of static RMPs on MHD activity has been performed which together with a new theoretical model sheds light on possible mechanisms for both mode stabilisation and stimulation of disruptions by external field perturbations. (author). 13 refs, 6 figs, 3 tabs.

8268 (IAEA-TECDOC–604, pp. 35-40) **Mode - Coupling triggering mechanism in tokamak major disruptions.** Vannucci, A. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Nascimento, I.C.; Caldas, I.L.; Gill, R.D. International Atomic Energy Agency, Vienna (Austria). May 1991. (CONF-9009463–: Technical committee on research using small tokamaks, Arlington, VA (United States), 27 Sep 1990). In *Research using small tokamaks: Proceedings of a technical committee meeting held in Arlington, Virginia, USA, 27-28 September 1990.* 198p. Order Number DE92615416. Source: OSTI; NTIS (US Sales Only); INIS.

The possible triggering mechanisms for the major disruptions in the small TBR-1 tokamak discharges and, later on, in the JET high current pulses were studied. Evidence could be found, in both cases, that the coupling of the m/n=1/1 with the other higher modes (but predominantly the m/n=2/1) are mainly responsible for triggering this instability. (author). 8 refs, 4 figs.

8269 (IAEA-TECDOC–604, pp. 103-109) **ADITYA: Initial results and status of edge control experiments.** Atrey, P.K. (and others); Bhatt, S.B.; Bora, D. ADITYA Team. International Atomic Energy Agency, Vienna (Austria). May 1991. (CONF-9009463–: Technical committee on research using small tokamaks, Arlington, VA (United States), 27 Sep 1990). In *Research using small tokamaks: Proceedings of a technical committee meeting held in Arlington, Virginia, USA, 27-28 September 1990.* 198p. Order Number DE92615416. Source: OSTI; NTIS (US Sales Only); INIS.

The initial results for ADITYA and status of edge control experiments are presented. Breakdown at low loop voltages (approx. 15V), peak currents up to 50 kA and discharge duration of 22 ms have been achieved at nominal operating parameters. The studies on the convective losses preceding the formation of rotational transform indicate that convection plays a more significant role than error magnetic fields in ADITYA. The current termination shows a sequence of positive spikes and decrease in plasma current until the external applied vertical magnetic field overcompensates the hoop force and causes a crashing of current channel towards inboard side of vacuum vessel. (author). 7 refs, 6 figs.

8270 (IAEA-TECDOC–604, pp. 117-122) **Potential formation in a tokamak plasma by limiter biasing and its effect on confinement properties.** Uesugi, Y. (Nagoya Univ. (Japan). Faculty of Engineering); Takamura, S.; Yamakawa, Y. International Atomic Energy Agency, Vienna (Austria). May 1991. (CONF-9009463–: Technical committee on research using small tokamaks, Arlington, VA (United States), 27 Sep 1990). In *Research using small tokamaks: Proceedings of a technical committee meeting held in Arlington, Virginia, USA, 27-28 September 1990.* 198p. Order Number DE92615416. Source: OSTI; NTIS (US Sales Only); INIS.

It is observed in HYBTOK-II tokamak that a negative change of the electric potential by negative limiter biasing is dependent sensitively on the magnetic configuration in the scrape-off region while the positive change is not. In the positive biasing the plasma potential increases in proportion to the bias voltage and enhances the radial electric field at the edge. On the other hand the plasma potential does not decrease deeply in the negative biasing. The positive radial electric field enhanced by the positive biasing seems to improve the particle confinement associated with a stabilization of the magnetic and electrostatic fluctuations. (author). 5 refs, 6 figs, 1 tab.

8271 (IAEA-TECDOC–604, pp. 137-141) **Phenomena connected with the radial electric field in tokamak plasmas.** Spineanu, F. (Institutul de Fizica Atomica, Bucharest (Romania)); Vlad, M. International Atomic Energy Agency, Vienna (Austria). May 1991. (CONF-9009463–: Technical committee on research using small tokamaks, Arlington, VA (United States), 27 Sep 1990). In *Research using small tokamaks: Proceedings of a technical committee meeting held in Arlington, Virginia, USA, 27-28 September 1990.* 198p. Order Number DE92615416. Source: OSTI; NTIS (US Sales Only); INIS.

The magnitude of the radial electric field and its role in the improved confinement regimes are examined in situations mainly relevant to small tokamaks. (author). 7 refs.

8272 (IAEA-TECDOC–604, pp. 175-179) **Eccentric operation modes in small tori and their physics.** Yoshida, Z. (Tokyo Univ. (Japan). Faculty of Engineering); Inoue, N.; Fujita, T. International Atomic Energy Agency, Vienna (Austria). May 1991. (CONF-9009463–: Technical committee on research using small tokamaks, Arlington, VA (United States), 27 Sep 1990). In *Research using small tokamaks: Proceedings of a technical committee meeting held in Arlington, Virginia, USA, 27-28 September 1990.* 198p. Order Number DE92615416. Source: OSTI; NTIS (US Sales Only); INIS.

Some different eccentric operation modes have been tried on small tori. These experiments are aimed at understanding strongly nonlinear processes in tokamak-type discharges with enhancing and extending their anomaly. In the ultra low q ($q < 1$) discharges, anomalous ion heating has been observed. The discharge is self-stabilized against kink instabilities through MHD relaxation process. Intense runaway discharges have been also studied to highlight the dynamics of high energy beam component in a tokamak type equilibrium. (author). 13 refs, 5 figs.

8273 (IAEA-TECDOC–604, pp. 143-146) **Multichord time resolved plasma radiation measurements with combination of absorber foils and microchannel plate on MT-1 tokamak.** Kardon, B. (Hungarian Academy of Sciences, Budapest (Hungary). Central Research Inst. for Physics); Bakos, J.S.; Buerger, G.; Kalvin, S.; Petravich, G.; Veres, G.; Zoletnik, S. International Atomic Energy Agency, Vienna (Austria). May 1991. (CONF-9009463–: Technical committee on research using small tokamaks, Arlington, VA (United States), 27 Sep 1990). In *Research using small tokamaks: Proceedings of a technical committee meeting held in Arlington, Virginia, USA, 27-28 September 1990.* 198p. Order Number DE92615416. Source: OSTI; NTIS (US Sales Only); INIS.

Absorber foils have been used with combination MCP (microchannel plate) detector for the measurements of soft and ultrasoft X-ray radiation of tokamak plasma with 2 μsec time resolution along 12 chords covering 2/3 of the plasma minor radius. Usefulness of such diagnostics has been demonstrated. (author). 5 refs, 4 figs.

8274 (IAEA-TECDOC–604, pp. 131-135) **Radial particle transport due to the turbulent and quasi-stationary cross field drift on the CASTOR tokamak.** Stoeckel, J. (Institute of Plasma Physics, Prague (Czechoslovakia)); Zacek, F.; Jakubka, K.; Kryska, L.; Dvoracek, L.; Pech, P.; Sachtleben, J. International Atomic Energy Agency, Vienna (Austria). May 1991. (CONF-9009463–: Technical committee on research using small tokamaks, Arlington, VA (United States), 27 Sep 1990). In *Research using small tokamaks: Proceedings of a technical committee meeting held in Arlington, Virginia, USA, 27-28 September 1990.* 198p. Order Number DE92615416. Source: OSTI; NTIS (US Sales Only); INIS.

The relative importance of the turbulent and quasi-stationary cross field drift induced particle transport and their poloidal asymmetries are experimentally investigated at low density discharges on the CASTOR tokamak. (author). 6 refs, 3 figs.

8275 (IAEA-TECDOC–604, pp. 111-115) **Edge studies, helicity current drive and diagnostic development on the Phaedrus-T tokamak.** Breun, R. (Wisconsin Univ., Madison, WI (United States). Dept. of Nuclear Engineering and Engineering Physics); Fonck, R.; Hershkowitz, N. International Atomic Energy Agency, Vienna (Austria). May 1991. Grant DE-FG02-88ER53264. (CONF-9009463–: Technical committee on research using small tokamaks, Arlington, VA (United States), 27 Sep 1990). In *Research using small tokamaks: Proceedings of a technical committee meeting held in Arlington, Virginia, USA, 27-28 September 1990.* 198p. Order Number DE92615416. Source: OSTI; NTIS (US Sales Only); INIS.

Phaedrus-T is a moderate sized tokamak with low toroidal field and substantial radiofrequency power capabilities. This machine has only recently become operational and full RF power is expected in the next year. The initial studies include edge modifications due to variable phased antenna structures and RF helicity current drive experiments. The tokamak is also being used as a test site for diagnostic development. (author). 7 refs, 2 figs.

8276 (IAEA-TECDOC–604, pp. 123-129) **LHCD experiment on the HT-6B tokamak.** LHCD Group; HT-6B Group. International Atomic Energy Agency, Vienna (Austria); Academia Sinica, Hefei, AH (China). Inst. of Plasma Physics. May 1991. (CONF-9009463–: Technical committee on research using small tokamaks, Arlington, VA (United States), 27 Sep 1990). In *Research using small tokamaks: Proceedings of a technical committee meeting held in Arlington, Virginia, USA, 27-28 September 1990.* 198p. Order Number DE92615416. Source: OSTI; NTIS (US Sales Only); INIS.

An LHCD experiment was performed on the HT-6B tokamak recently. The rf system consisted of a 100kW, 2.45GHz power source and a multijunction antenna with relatively narrow power spectrum. At relatively high density, $\eta \approx 0.2$ ($10^{19}\mathrm{M}^{-2}$kA/kW) was achieved. The MHD modes and sawteeth were strongly affected by LHW. (author). 8 figs, 1 tab.

8277 (IAEA-TECDOC–604, pp. 181-188) **Studies of turbulence and wave coupling based on self organization process at SK/CG-1 machine.** Sinman, S. (Middle East Technical Univ., Ankara (Turkey). Plasma Engineering Lab.); Sinman, A. International Atomic Energy Agency, Vienna (Austria). May 1991. (CONF-9009463–: Technical committee on research using small tokamaks, Arlington, VA (United States), 27 Sep 1990). In *Research using small tokamaks: Proceedings of a technical committee meeting held in Arlington, Virginia, USA, 27-28 September 1990.* 198p. Order Number DE92615416. Source: OSTI; NTIS (US Sales Only); INIS.

In the SK/CG-1 Machine, using the He gas pressures between 30 and 50 mTorr, a complex turbulence regime has been determined. During the on-set phase of 0.35 μs, besides the anomalous plasma resistivity, the ion acoustic instability is also observed. At the C-gun the plasma belt which contains the hot electrons at the energy range of 60-80 eV, breaks from the gun electrodes, the translation into plasmoid case occurs and then high electric fields about 5 kV/cm in the poloidal frame of the gun are produced. Thus, the electron-ion two stream instability and just after 0.1 μs, the ion acoustic instability is started. On the other hand, in the second phase, the beam plasma instability and the ion acoustic instability are parallelly sustained. The beam plasma instability includes also the W3 ion cyclotron instability. In addition, due to the toroidal magnetic field of poloidal frame and the electric field perpendicular to it, the density and temperature gradients come into existence. Probably at the end of the resonance of the drift wave and the ion acoustic wave, the drift wave turbulence commences. The time constant of the octagonal flux conserver is about 28-30 ms. After the turbulence, the electric field on the poloidal frame drops down to 900 V/cm and it is kept for 300 ms (E/e). Thus a wave coupling mechanism depending on the self organization process is sustained. Nevertheless, it has not yet been understood exactly if the propagation at the flux conserver is realized due to the reflections or the helicity transfer from the wave to the plasma. The frequency of the closed wave packet changes in the range of 25-5 kHz depending on the electron temperatures in the range of 30-5 eV. The average electron density is about $10^{14}\mathrm{cm}^{-3}$ and the global energy confinement times are found in the range of 65-250 μs. (author). 7 refs, 6 figs.

8278 (IAEA-TECDOC–604, pp. 147-154) **Multicharged ion-atom collisions: Application for tokamak edge plasma physics.** Unterreiter, E. (Technische Univ., Vienna (Austria). Inst. fuer Allgemeine Physik); Aumayr, F.; Winter, H.P. International Atomic Energy Agency, Vienna (Austria). May 1991. (CONF-9009463–: Technical committee on research using small tokamaks, Arlington, VA (United States), 27 Sep 1990). In *Research using small tokamaks: Proceedings of a technical committee meeting held in Arlington, Virginia, USA, 27-28 September 1990.* 198p. Order Number DE92615416. Source: OSTI; NTIS (US Sales Only); INIS.

Multicharged ion-atom collisions are of interest for tokamak edge plasma physics for several reasons. Electron capture reactions taking place very probably in such collisions give rise to production of highly excited ion states from which characteristic line radiation is emitted, which produces a localized efficient energy drain from the plasma. On the other hand, by controlled application of such electron capture processes the temperature profile of the plasma may be modified to achieve optimization of plasma confinement conditions. Line radiation from such excited impurity ions can also be utilized for plasma diagnostics, using both passive and neutral beam-activated photon spectroscopies. We have recently studied electron capture in ion-atom collisions toward the following goals. Electron capture by C^{q+} and O^{q+} (q=1,2) from H_2 and He is of interest in the outermost region of tokamak discharge plasmas. Available cross section data are scarce and not very reliable, which is primarily caused by unknown long-lived excited (metastable) ion beam fractions in the corresponding cross section measurements. State-selective cross sections for electron capture by multicharged ions (in particular C^{q+}) from Li(2s) are needed for the application of Li beam-activated charge exchange spectroscopy (Li-CXS), by which means the impurity ion concentrations in tokamak edge plasmas can be measured with excellent spatial and temporal resolution. In this paper we present recently obtained cross sections for processes. The experimental methods for measuring electron capture cross sections separately for ground state and metastable ions are described. We demonstrate that for low primary ion charge states these electron capture cross sections can be much larger for the metastable than for the ground state ions, which stresses the importance for careful consideration of possible effects as caused by the participation of metastable ions in such collisional processes.

8279 (IC–91/34) **Analytic solutions of the time-dependent quasilinear diffusion equation with source and loss terms.** Hassan, M.H.A. (International Centre for Theoretical Physics, Trieste (Italy)); Hamza, E.A. International Centre for Theoretical Physics, Trieste (Italy). Oct 1991. 16p. Order Number DE92615435. Source: OSTI; NTIS (US Sales Only); INIS.

A simplified one-dimensional quasilinear diffusion equation describing the time evolution of collisionless ions in the presence of ion cyclotron resonance heating (ICRH) and sources and losses is solved analytically for all harmonics of the ion cyclotron frequency. Simple time-dependent distribution functions which are initially Maxwellian and vanish at high energies are obtained and calculated numerically for the first four harmonics of resonance heating. It is found that the strongest ion-tail of the resulting anisotropic distribution function is driven by heating at the second harmonic followed by heating at the fundamental frequency. (author). 5 refs, 5 figs.

8280 (IC–91/109) **On the generation of large-amplitude plasma wakefields with low phase velocities by an intense short laser pulse.** Murusidze, I.G.; Tsintsadze, L.N. International Centre for Theoretical Physics, Trieste (Italy). Jun 1991. 7p. Order Number DE92609543. Source: OSTI; NTIS (US Sales Only); INIS.

The problem of propagating large-amplitude laser pulses through plasmas has many unresolved issues. One of them is a group velocity of such pulses. We demonstrate that Gaussian pulses with lower amplitudes and lower group velocities are able to generate the wakefields having greater amplitudes than wakefields produced by Gaussian pulses with higher amplitudes but phase velocities close to the speed of light.

8281 (IC–91/121) **Alfven waves in inhomogeneous magnetic fields: An integro-differential equation formulation.** Uberoi, C.; Sedlacek, Z. International Centre for Theoretical Physics, Trieste (Italy). Jun 1991. 6p. Order Number DE92609544. Source: OSTI; NTIS (US Sales Only); INIS.

An integro-differential formulation for the equation governing the Alfven waves in inhomogeneous magnetic fields is shown to be similar to the polyvibrating equation of Mangeron. Exploiting this similarity, a time-dependent solution for smooth initial conditions is constructed. The important feature of this solution is that it separates the parts giving the Alfven wave oscillations of each layer of plasma and the interaction of these oscillations representing the phase mixing. (author). 8 refs.

8282 (IC–91/177) **Electrostatic drift vortices in a hot rotating strongly magnetized electron-positron pulsar plasma.** Mofiz, U.A. International Centre for Theoretical Physics, Trieste (Italy). Jul 1991. 8p. Order Number DE92614464. Source: OSTI; NTIS (US Sales Only); INIS.

Electrostatic drift wave in a hot rotating and strongly magnetized electron-positron pulsar plasma is considered. Using relativistic two fluid equations a pair of coupled nonlinear equations is derived. It is shown that the wave can propagate in the form of two-dimensional dipolar vortices at ultrarelativistic temperature (T much greater than mc^2) of the plasma. The latter may affect the energy transport in the hot plasma, which can lead to a new turbulent state in the pulsar magnetosphere. (author). 16 refs.

8283 (IC–91/178) **Alfven solitons in a dense ultrarelativistic electron-positron pulsar plasma.** Mofiz, U.A. International Centre for Theoretical Physics, Trieste (Italy). Jul 1991. 9p. Order Number DE92614465. Source: OSTI; NTIS (US Sales Only); INIS.

The nonlinear propagation of Alfven wave in a hot electron-positron plasma of a pulsar magnetosphere is investigated. Alfven solitons are found to exist at ultrarelativistic (T much greater than mc^2) temperature. Landau damping and three dimensional modulation perturbation of solitons are discussed. (author). 11 refs.

8284 (IC–91/182) **Nonlinear interaction of waves at the input of a beam into a semi-bounded warm plasma.** Hussein, A.M. International Centre for Theoretical Physics, Trieste (Italy). Jul 1991. 7p. Order Number DE92614466. Source: OSTI; NTIS (US Sales Only); INIS.

An investigation is made of the nonlinear interaction of waves at the input of a beam into a semi-bounded warm plasma. The amplitudes of the wave have been found. The effect of the thermal velocity is to increase the amplitude of the generated waves. The absorption of the energy of these waves by the plasma can exceed the energy at the expense of waves with the basic frequency. (author). 7 refs.

8285 (INIS-mf–13070) **Reflectometry and transport in thermonuclear plasmas in the Joint European Torus.** Sips, A.C.C. Technische Univ. Eindhoven (Netherlands). 22 Mar 1991 127p. Order Number DE92614448. Source: OSTI; NTIS (US Sales Only); INIS.

This work was performed as part of the research program association agreement of EURATOM and the 'Stichting voor Fundamenteel Onderzoek der Materie FOM' (Foundation for Fundamental Research into Matter), with financial support from the 'Nederlandse Organisatie voor Weten-schappelijk Onderzoek WNO' (Netherlands Organization for Scientific Research) and EURATOM. It was carried out under the TASK agreement (FOM/TA2) between JET and the FOM Institute for Plasma Physics 'Rijnhuizen', the Netherlands, and the Joint European Torus (JET) in Culham, England; includes summary in Dutch.

The subjects of this thesis are the study of microwave reflectometry as a method to measure electron density profiles, and the study of particle and energy transport in thermonuclear plasmas. In the transport studies data of a 12-channel reflectometer system are used to analyze the propagation of electron density perturbations in the plasma. The measurements described in this thesis are performed in the plasmas in the Joint European Torus (JET). The main points of study described are based on microwave reflectometry, the principles of which are given. Two modes of operation of a reflectometer are described. Firstly, electro-magnetic waves with constant frequencies may be launched into the plasma to measure variations in the electron density profile. Secondly, the absolute density profile can be measured with a reflectometer, when the source frequencies are swept. (author). 56 refs.; 41 figs.; 5 tabs.

8286 (INIS-mf–13075) **Electron and current density measurements on tokamak plasmas.** Lammeren, A.C.A.P. van. Rijksuniversiteit Utrecht (Netherlands). 18 Sep 1991 140p. Order Number DE92614449. Source: OSTI; NTIS (US Sales Only); INIS.

This thesis is financially supported by the Foundation for Fundamental Research of Matter (FOM) and EURATOM. The work has been carried out on the FOM-Institute for Plasmaphysics 'Rijnhuizen', Nieuwegein, Netherlands; includes summary in Dutch.

The first part of this thesis describes the Thomson-scattering diagnostic as it was present at the TORTUR tokamak. For the first time with this diagnostic a complete tangential scattering spectrum was recorded during one single laser pulse. From this scattering spectrum the local current density was derived. Small deviations from the expected gaussian scattering spectrum were observed indicating the non-Maxwellian character of the electron-velocity distribution. The second part of this thesis describes the multi-channel interferometer/polarimeter diagnostic which was constructed, build and operated on the Rijnhuizen Tokamak Project (RTP) tokamak. The diagnostic was operated routinely, yielding the development of the density profiles for every discharge. When ECRH (Electron Cyclotron Resonance Heating) is switched on the density profile broadens, the central density decreases and the total density increases, the opposite takes place when ECRH is switched off. The influence of MHD (magnetohydrodynamics) activity on the density was clearly observable. In the central region of the plasma it was measured that in hydrogen discharges the so-called sawtooth collapse is preceded by an m=1 instability which grows rapidly. An increase in radius of this m=1 mode of 1.5 cm just before the crash is observed. In hydrogen discharges the sawtooth induced density pulse shows an asymmetry for the high- and low-field side propagation. This asymmetry disappeared for helium discharges. From the location of the maximum density variations during an m=2 mode the position of the q=2 surface is derived. The density profiles are measured during the energy quench phase of a plasma disruption. A fast flattening and broadening of the density profile is observed. (author). 95 refs.; 66 figs.; 7 tabs.

8287 (INIS-mf--13076) **Low-energy hydrogen flux measurements at the TORTUR tokamak with negative ion conversion.** Toledo, Wiebo van. Rijksuniversiteit Utrecht (Netherlands). 13 Jun 1990 136p. Order Number DE92614450. Source: OSTI; NTIS (US Sales Only); INIS.

This work was performed as part of the research programme of the Foundation for Fundamental Research of Matter (FOM), with financial support from the Netherlands Organization for Scientific Research (NWO) and EURATOM. It was carried out at the FOM-Institute for Plasma-Physics 'Rijnhuizen', Nieuwegein, the Netherlands; includes summary in Dutch.

The interaction of a tokamak plasma with the vessel wall is one of the most important subjects in thermonuclear research. The information about this interaction is not complete without direct detection of the outward stream of low-energy, down to a few electronvolts, neutral hydrogen or deuterium atoms. The detection of these atoms is the subject of this thesis. An appropriate method to analyse the atoms which are emitted from the edge plasma is to use a time-of-flight analyser. This kind of apparatus selects particles according to their velocities with-out distinguishing between different masses. If these analysers use the Daly-method the lowest measurable energy of the hydrogen atoms is approximately 25 electronvolts. To increase the detection efficiency a new detection method was developed. This new method uses the conversion of hydrogen atoms into H- ions on a cesiated tungsten surface. By this conversion the lowest measurable energy is decreased down to 5 electron-volt. (author). 93 refs.; 44 figs.; 7 tabs.

8288 (IPPT-IFTR--49/1988) **Stability conditions for double layers in plasma in hydrodynamic and kinetic description.** Zuchowski, K. Polska Akademia Nauk, Warsaw (Poland). Inst. Podstawowych Problemow Techniki. 1988. 19p. (In Polish). Order Number DE92614467. Source: OSTI; NTIS (US Sales Only); INIS.

The conditions of existence and stability of double layers in hydrodynamic and kinetic description of plasma are shortly considered. (A.S.).

8289 (IPPT-IFTR--50/1988) **Continuous transform group for multiple plasma model of Vlasov-Poisson-Amper.** Atamaniuk, B. Polska Akademia Nauk, Warsaw (Poland). Inst. Podstawowych Problemow Techniki. 1988. 15p. (In Polish). Order Number DE92614468. Source: OSTI; NTIS (US Sales Only); INIS.

The continuous transform group for 3 models of multiple plasma , which is described by Vlasov-Poisson-Amper equations system, is calculated. (A.S.).

8290 (JAERI-M--91-131) **Evaluation of mode purity of ordinary and extraordinary modes by fixed elliptically polarized wave for ECH and ECCD.** Saigusa, Mikio (Japan Atomic Energy Research Inst., Naka, Ibaraki (Japan). Naka Fusion Research Establishment). Japan Atomic Energy Research Inst., Tokyo (Japan). Aug 1991. 20p. Order Number DE92750961. Source: OSTI; NTIS (US Sales Only); INIS.

Mode separation ratio from an arbitrary elliptically polarized electromagnetic wave to an ordinary and an extraordinary modes on a plasma surface for oblique launch is evaluated quantitatively for designing an electron cyclotron current drive (ECCD) antenna. An optimized elliptical polarization for the wide range of injection angles and magnetic fields is firstly investigated for ECCD and ECH experiments. (author).

8291 (JAERI-M--91-135) **Spectroscopic studies in JT-60.** Kubo, Hirotaka (Japan Atomic Energy Research Inst., Naka, Ibaraki (Japan). Naka Fusion Research Establishment). Japan Atomic Energy Research Inst., Tokyo (Japan). Sep 1991. 146p. (In Japanese). Order Number DE92750963. Source: OSTI; NTIS (US Sales Only); INIS.

This paper summarizes the spectroscopic studies in JT-60 which was constructed to explore the break-even plasma. The content is as follows; (1) In order to study impurity behaviors in the JT-60 plasma, a spectroscopic diagnostic system, which is capable of measuring many spectra of impurity ions and their spatial distributions, has been developed. (2) A Rowland-type grazing incidence monochromator has been absolutely calibrated with a branching ratio method. And multi-channel spectrometers have been absolutely calibrated in the wavelength region of 275-1250A using synchrotron radiation. (3) The transport coefficients (D, c_v) for impurity have been measured by observing the time evolutions of line intensities of titanium in ohmically heated and neutral beam heated discharges. (4) Impurity contents have been measured in limited discharges and diverted discharges with different materials for the first wall, namely metallic wall and graphite wall. (5) For the Lyman-α line of TiXXII, the intensity ratio of its fine structure components ($1\ {}^2S_{1/2}$ - $2\ {}^2P_{1/2,3/2}$) has been measured in discharges with various heating modes. (6) Energy levels and oscillator strengths have been calculated for MoXV-XL. (J.P.N.).

8292 (JAERI-M--91-156) **Fusion gain due to high energy ions accelerated by additional heating.** Hamamatsu, Kiyotaka (Japan Atomic Energy Research Inst., Naka, Ibaraki (Japan). Naka Fusion Research Establishment); Azumi, Masafumi; Fukuyama, Atsushi. Japan Atomic Energy Research Inst., Tokyo (Japan). Oct 1991. 21p. (In Japanese). Order Number DE92751038. Source: OSTI; NTIS (US Sales Only); INIS.

In order to investigate a gain of fusion reaction caused by high energy ions, the ICRF wave propagation equation and the Fokker-Planck equation with the effects of particle acceleration due to the rf-electric field are numerically analyzed in a self-consistent manner. In the ICRF and NBI heated plasmas, the input power dependences of fusion output power of D-D, D-^{3}He and D-T reactions are calculated and compared with each other. As for the ICRF heating conditions, the higher harmonic resonance up to the third one and phase control of antenna currents are taken into account. To optimize the NBI heating condition on a fusion reaction, the beam energy needs to be exceeded the energy where the fusion cross section is maximum. In the case of ICRF heating, fast ions are accelerated beyond the several MeV by the velocity diffusion coefficient due to rf-electric field in the Fokker-Planck equation. The ICRF heating condition does not affect the fusion output so seriously from this standpoint. As for the D-D reaction, however, the third harmonic resonance heating is more effective than the second one. Because, the fusion cross-section of D-D reaction has a maximum value at high energy range ($3 \approx 4$ MeV) and the third harmonic resonance heating accelerates higher energy particles than the second one. On the other hand, in order to avoid the direct power loss by electron Landau damping in the wave propagation process, the phase difference of antenna currents needs to be inphase. (author).

8293 (JAERI-M--91-159) **Annual report of the Naka Fusion Research Establishment for the period of April 1, 1990 to March 31, 1991.** Japan Atomic Energy Research Inst., Tokyo (Japan). Oct 1991. 147p. Order Number DE92751039. Source: OSTI; NTIS (US Sales Only); INIS.

R and D activities of the Naka Fusion Research Establishment, JAERI, are reported for the period from April 1, 1990 to March 31, 1991. Since the shutdown of JT-60 in November 1989, the reconstruction work of the JT-60 device was continued until the end of March 1991. In the JT-60 Upgrade, the poloidal field coils and vacuum vessel were renewed and the plasma current was planned to increase up to 6 MA with lower single null divertor. The divertor plates were designed to be toroidally continuous and to use high-heat-conduction C/C composite materials. Another objective of JT-60U is to facilitate tokamak experiments with deuterium as the working gas. In the JFT-2M program, a system for divertor bias experiments was brought into operation and initial experiments were started to study its effects on plasma discharges. Effects of ergodic magnetic limiter on H-modes were examined and stationary H-modes were obtained under the control of ergodic magnetic limiter currents. The DIII-D program was highlighted by the attainment of 11% beta with a double null divertor plasma. As for the fusion engineering research, development activities of the ceramic turbo-viscous pump and the surface insulation techniques for the tokamak in-vessel components are remarked in the vacuum technology area. In the high heat flux experiments with the JAERI Electron Beam Irradiation Stand (JEBIS), carbon-based materials and refractory metals were tested to evaluate surface erosion at plasma disruptions. The ITER Conceptual Design Activities, which began in April 1988 under the auspices of the IAEA, were successfully completed in December 1990. A lot of contributions to the program were made by JAERI people to support the design and R and D activities and to prepare a plan for the forthcoming Engineering Design Activities. (J.P.N.).

8294 (KFTI–89-30) **Stability of magnetic configuration and limit equilibrium plasma pressure in stellarator.** Aleksin, V.F.; Sebko, V.P.; Tyupa, V.I. AN Ukrainskoj SSR, Kharkov (Ukrainian SSR). Fiziko-Tekhnicheskij Inst. 1989. 14p. (In Russian). Order Number DE92609370. Source: OSTI; NTIS (US Sales Only); INIS.

Criteria of limited equilibrium plasma pressure which are connected with the violation of magnetic configuration stability in relation to various resonance perturbations are considered. 22 refs.; 1 fig.

8295 (KFTI–89-31) **Rotational transform angles in the U-2M torsatron with account of plasma finite pressure.** Aleksin, V.F.; Tyupa, V.I. AN Ukrainskoj SSR, Kharkov (Ukrainian SSR). Fiziko-Tekhnicheskij Inst. 1989. 8p. (In Russian). Order Number DE92609371. Source: OSTI; NTIS (US Sales Only); INIS.

Universal dependences for the stellarator (torsatron) rotational transformation angles are obtained using the formulas of averaging by magnetic surfaces with regard to the plasma finite pressure. 14 refs.; 2 figs.

8296 (KFTI–89-48) **Experiments on the laser injection of impurity atoms at the Uragan-3 torsatron.** Berezhnyj, V.L. (and others); Vojtsenya, V.S.; Volkov, Ya.F. AN Ukrainskoj SSR, Kharkov (Ukrainian SSR). Fiziko-Tekhnicheskij Inst. 1989. 24p. (In Russian). Order Number DE92609372. Source: OSTI; NTIS (US Sales Only); INIS.

Experiments on carbon atom injection into ICR-discharge hydrogen plasma (n-bar$_e$=4x10^{12} cm^{-3}, $T_e \simeq 250$ eV, $T_i \simeq 350$ eV, B_0=046Tl) are conducted at a three-pass Uragan-3 torsatron. Injection is perormed by ruby laser radiation effect on the surface of steady-state graphite target, mounted on the internal surface of one of screw conductors. Comparison of the experimentally observed time course of C5 line intensity to the results of mathematic simulation of carbon transfer in plasma gives the values of diffusion coefficient and convection rate D=18x10^{3}cm^2/s, V=4.5x10^{3}cm/s respectively is performed. The minimal carbon atom concentration in plasma measured (without injection) is at the level of 5x10^{-3}n-bar$_e$. Radiation losses conditioned by the background carbon under the conditions of the purest unit are at the level of 200 W. Radiation losses in the range of 0.1-10nm, linked with carbon, make up ≈2% of total radiation losses of plasma. 20 refs.; 13 figs.

8297 (KFTI–89-59) **Effect of high-power RF-fields on the inhomogeneity of plasma density in magnetized plasma waveguide.** Bliokh, Yu.P.; Lyubarskij, M.G. AN Ukrainskoj SSR, Kharkov (Ukrainian SSR). Fiziko-Tekhnicheskij Inst. 1989. 9p. (In Russian). Order Number DE92609545. Source: OSTI; NTIS (US Sales Only); INIS.

The mechanism of inhomogeneities growth in magnetized plasma waveguide in the case when the level of HF-power density exceeds the thermal power density is indicated. 13 refs.

8298 (LA-UR–91-4080) **ITER edge-plasma conditions versus pump configuration.** Werley, K.A. (Los Alamos National Lab., NM (United States)); Cohen, S.A. Los Alamos National Lab., NM (United States). 11 Dec 1991. 23p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36 ;AC02-76CH03073. (CONF-920311–1: 10. international conference on plasma-surface interactions in controlled fusion devices, Monterey, CA (United States), 30 Mar - 3 apr 1992). Order Number DE92005053. Source: OSTI; NTIS; INIS; GPO Dep.

Two-dimensional fluid simulations of ITER double-null divertor scrape-off-layer plasma conditions have been restricted to examining a single outboard divertor plate with up/down symmetry assumed. The present work evaluates the effect of pumping at only one plate on particle flow patterns and other parameters of interest. Pumping only at one plate results in reduced sheath temperatures at both plates but an increased heat flux at the pumped plate. The physics assumptions for separatrix density (n_{SEP}=(n)/3.5) and for radial particle diffusivity (D=0.66m^2/s) used in the simulation of ITER edge plasma result in particle throughputs two orders of magnitude greater than that required for acceptable fusion-product ash removal rates. The particle confinement time, however, is an order of magnitude shorter than the transport energy confinement time, τ_E. Plasmas (D=0.04m^2/s) which would have $\tau_p \sim \tau_E$ are evaluated and found to have unacceptably high plasma temperatures and heat flux at the plate. Ash removal rates are still acceptable. A plasma recycle coefficient of R=0.965 reduces the particle throughput by a factor of 2.8 below the no-recycle case.

8299 (LRP–429/91) **Ideal toroidal stability β limits and shaping effects for reversed field pinch configurations.** Paccagnella, R. (Padua Univ., Ist. Gas Ionizzati, Padua (Italy)); Bondeson, A.; Luetjens, H. Ecole Polytechnique Federale, Lausanne (Switzerland). Centre de Recherche en Physique des Plasma (CRPP). May 1991. 28p. Order Number DE92614469. Source: OSTI; NTIS (US Sales Only); INIS.

The influence of shaping and toroidicity on the ideal MHD stability of the Reversed Field Pinch (RFP) is investigated both with respect to current and pressure driven modes. It is found that triangularity and x-point shaping does not significantly modify the operational limits of RFP, while ellipticity and D-shaping is destabilizing. A simple relation for the stability of current driven modes is also given. (author) 12 figs., 17 refs.

8300 (LRP–432/91) **Non-local effects of alpha particles on second-harmonic heating.** Sauter, O. (Ecole Polytechnique Federale, Lausanne (Switzerland). Centre de Recherche en Physique des Plasma (CRPP)); Vaclavik, J. Ecole Polytechnique Federale, Lausanne (Switzerland). Centre de Recherche en Physique des Plasma (CRPP). Aug 1991. 35p. Order Number DE92614479. Source: OSTI; NTIS (US Sales Only); INIS.

A model based on the linearized Vlasov-Maxwell equations, taking into account the non-local interactions of particles due to their finite Larmor radii, has been developed. Assuming an inhomogeneous 1-D slab plasma, Maxwellian equilibrium distribution functions and k_y=0, it leads to a system of one first-order and two second-order integro-differential equations for E_x and E_y, E_z respectively. These equations are valid for arbitrary value of k/ρ_σ, where k/ρ_σ is the perpendicular wavenumber and ρ_σ the Larmor radius of species σ. Therefore, the code SEMAL, solving these equations, is well appropriate for studying the effects of alpha particles on the ion cyclotron range of frequency (ICRF) heating. These effects are shown to be much less significant for heating at the second harmonic of deuterium than expected from local models. Other heating scenarii of deuterium as well as the influence of k_z, T_α, non-Maxwellian distribution functions and n_α/n_e are also investigated. The results indicate under which conditions the power absorption by alpha particles start to dominate and, therefore, degrade the heating efficiency. (author) 10 figs., 10 refs.

8301 (LRP–433/91) **Stability of the n=1 ideal internal kink for large aspect ratio Shafranov equilibria.** Bondeson, A. (Ecole Polytechnique Federale, Lausanne (Switzerland). Centre de Recherche en Physique des Plasma (CRPP)); Bussac, M.N. Ecole Polytechnique Federale, Lausanne (Switzerland). Centre de

Recherche en Physique des Plasma (CRPP). Sep 1991. 9p. Order Number DE92614470. Source: OSTI; NTIS (US Sales Only); INIS.

Stability limits for the ideal internal kink mode are calculated analytically for the Shafranov current profile using the large aspect ratio expansion. For equilibria with q(a)>2 and circular cross section, the maximum stable poloidal beta is below 0.1. In the absence of a conducting wall, an equilibrium with q(a)<2 is unstable at arbitrarily small positive poloidal beta or shear inside the q = 1 surface. The effects of non-circularity are discussed and quantitative results are given for elliptic cross sections. (author) 2 figs., 10 refs.

8302 (LRP–434/91) **The effects of plasma deformability on the feedback stabilization of axisymmetric modes in tokamak plasmas.** Ward, D.J. (Ecole Polytechnique Federale, Lausanne (Switzerland). Centre de Recherche en Physique des Plasma (CRPP)); Jardin, S.C. Ecole Polytechnique Federale, Lausanne (Switzerland). Centre de Recherche en Physique des Plasma (CRPP). Sep 1991. 54p. Order Number DE92614471. Source: OSTI; NTIS (US Sales Only); INIS.

The effects of plasma deformability on the feedback stabilization of axisymmetric modes of tokamak plasmas are studied. It is seen that plasmas with strongly shaped cross sections have unstable motion different from a rigid shift. Furthermore, the placement of passive conductors is shown to modify the non-rigid components of the eigenfunction in a way that reduces the stabilizing eddy currents in these conductors. Passive feedback results using several equilibria of varying shape are presented. The eigenfunction is also modified under the effects of active feedback. This deformation is seen to depend strongly on the position of the flux loops which are used to determine plasma vertical position for the active feedback system. The variations of these non-rigid components of the eigenfunction always serve to reduce the stabilizing effect of the active feedback system by reducing the measurable poloidal flux at the flux-loop locations. Active feedback results are presented for the PBX-M tokamak configuration. (author) 19 figs., 2 tabs., 30 refs.

8303 (LRP–435/91) **Frequency effects in silane plasmas for PECVD.** Howling, A.A. (Ecole Polytechnique Federale, Lausanne (Switzerland). Centre de Recherche en Physique des Plasma (CRPP)); Dorier, J.L.; Hollenstein, C.; Finger, F.; Kroll, U. Ecole Polytechnique Federale, Lausanne (Switzerland). Centre de Recherche en Physique des Plasma (CRPP). Sep 1991. 21p. Order Number DE92614451. Source: OSTI; NTIS (US Sales Only); INIS.

It is generally recognised that the excitation frequency is an important parameter in rf plasma-assisted deposition. VHF silane plasmas (50-100 MHz) have been shown to produce high quality amorphous silicon films up to 20 A/s, and therefore the aim of this work is to compare the VHF range with the 13.56 MHz industrial frequency in the same reactor. The principal diagnostics used are electrical measurements and a CCD camera for spatially-resolved plasma-induced emission with Abel inversion of the plasma image. We present a comparative study of key discharge parameters such as deposition rates, plasma uniformity, ion impact energy, power transfer efficiency and powder formation for the rf range 13-70 MHz. (author) 5 figs., 19 refs.

8304 (LRP–436/91) **Powder dynamics in VHF silane plasmas.** Dorier, J.L. (Ecole Polytechnique Federale, Lausanne (Switzerland). Centre de Recherche en Physique des Plasma (CRPP)); Hollenstein, C.; Howling, A.A.; Kroll, U. Ecole Polytechnique Federale, Lausanne (Switzerland). Centre de Recherche en Physique des Plasma (CRPP). Sep 1991. 20p. Order Number DE92614459. Source: OSTI; NTIS (US Sales Only); INIS.

Particulate contamination produced during plasma-assisted deposition of amorphous silicon devices can be responsible for reduced quality and yield. The threshold for power formation imposes an upper limit on the rf power and hence the deposition rate. In this work, the parallel-plate capacitor discharge volume is illuminated and global, spatio-temporal powder production is determined visually and from observed modifications to the discharge electrical properties such as the matching condition, the dc self bias and the rf power transfer efficiency. A systematic study has been made of the powder-free operational space as a function of rf power, rf frequency (13.56-70 MHz) and substrate temperature. (author) 6 figs., 18 refs.

8305 (LRP–438/91) **Density limit disruption studies in the TCA tokamak.** Pietrzyk, Z.A. (Ecole Polytechnique Federale, Lausanne (Switzerland). Centre de Recherche en Physique des Plasma (CRPP)); Pochelon, A.; Behn, R.; Bondeson, A.; Duperrex, P.A.; Duval, B.P.; Joye, B.; Knight, A.J.; Marchal, B.; Nieswand, C. Ecole Polytechnique Federale, Lausanne (Switzerland). Centre de Recherche en Physique des Plasma (CRPP). Oct 1991. 74p. Order Number DE92614433. Source: OSTI; NTIS (US Sales Only); INIS.

This paper describes density limit plasma disruptions that take place during the density increase in the plasma current flat top of TCA. In TCA, such disruptions have been observed to occur at two different densities, depending on discharge programming. An efficient method of achieving high density is to introduce a strong influx of neutral gas to the plasma, which was found to allow the plasma density to cross a range of densities that was otherwise unstable. In this kind of operation the disruption was observed to be approached from high to low plasma inductance in contrast to a slower density rise where the inductance is increasing. The study of the plasma temperature and density profiles as the disruption is approached, together with the characterisation of the mode and sawtooth activity, gives further insights into the physics of plasma disruptions. (author) 32 figs., 3 tabs., 30 refs.

8306 (NIFS–100) **Fluid description of ponderomotive force compatible with the kinetic one in a warm plasma.** Hojo, Hitoshi (Tsukuba Univ., Ibaraki (Japan). Plasma Research Center); Ogawa, Tomoko; Kono, Mitsuo. National Inst. for Fusion Science, Nagoya (Japan). Jul 1991. 11p. Order Number DE92751077. Source: OSTI; NTIS (US Sales Only); INIS.

The ponderomotive effect of electromagnetic wave fields is practically very important in such cases as RF stabilization, RF-induced transport in magnetically confined plasma and so on. However, theoretically there are still discrepancies among the expressions derived by a number of authors. In this short note, attention is restricted to the discrepancy between fluid and kinetic expressions of the ponderomotive force often found in literatures dealing with warm plasma, and where it stems from and how it is resolved are discussed. The ponderomotive force density of electromagnetic wave fields based on Vlasov theory has been obtained. Also the fluid ponderomotive force density is given. The case of electrostatic high frequency waves in a unmagnetized plasma is considered. The discrepancy between both expressions was found. This discrepancy in a warm plasma is due to the lack of a wave-induced contribution to the thermal pressure in the fluid description of ponderomotive force density. The fluid description of the ponderomotive force can be made compatible with the kinetic one in warm plasma. (K.I.).

8307 (NIFS–102) **Rotations of bulk ions and impurities in non-axisymmetric toroidal systems.** Nakajima, Noriyoshi; Okamoto, Masao. National Inst. for Fusion Science, Nagoya (Japan). Jul 1991. 21p. Order Number DE92750966. Source: OSTI; NTIS (US Sales Only); INIS.

Neoclassical rotations are investigated theoretically for a plasma consisting of electrons, bulk ions, and impurities in non-axisymmetric toroidal systems. Impurity ions are assumed to lie in the Pfirsch-Schlueter collisionality regime. The results include the case of tokamaks. It is found that the rotations of impurities are generally different from those of bulk ions. The difference comes from mainly the different diamagnetic flows between bulk ions and impurities. In the $1/\nu$ regime or banana regime the gradient of bulk ion temperature may be another cause for the different rotations between the two species. However, in the region where the configuration is far from the axisymmetry the cause of different rotations is just the different diamagnetic flows. As the poloidal rotations depend on the radial electric field contrary to the axisymmetric system, a relationship, which does not include the radial electric field, can be derived between poloidal and toroidal rotations. By estimating this relationship based on the measured rotations the present neoclassical theory can be validated without knowledge of radial electric field. (author).

8308 (NIFS-MEMO–1) **Feedback control of plasma equilibrium with control system aided by personal computer on the JIPP T-IIU tokamak.** Tsuzuki, T.; Toi, K.; Matsuura, K. National Inst. for Fusion Science, Nagoya (Japan). Apr 1991. 35p. (In

Japanese). Order Number DE92750824. Source: OSTI; NTIS (US Sales Only); INIS.

A feedback control system aided by a personal computer is developed to maintain plasma position on the required position in the JIPP T-IIU tokamak. The personal computer enables to adjust various control parameters easily. In this control system, a control demand for driving the power supply of feedback controlled vertical field coils is composed to be proportional to a total plasma current. This system has been successfully employed throughout the discharge where the plasma current substantially changes from zero to hundreds of kiloamperes, because the feedback control can be done, being independent of the plasma current. The analysis of this feedback control system taken into account of digital sampling agrees well with the experimental results. (author).

8309 (PPPL–2784) **Transport simulations TFTR: Theoretically-based transport models and current scaling.** Redi, M.H.; Cummings, J.C.; Bush, C.E.; Fredrickson, E.; Grek, B.; Hahm, T.S.; Hill, K.W.; Johnson, D.W.; Mansfield, D.K.; Park, H.; Scott, S.D.; Stratton, B.C.; Synakowski, E.J.; Tang, W.M.; Taylor, G. Princeton Univ., NJ (United States). Plasma Physics Lab. Dec 1991. 56p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03073. Order Number DE92005130. Source: OSTI; NTIS; INIS; GPO Dep.

In order to study the microscopic physics underlying observed L-mode current scaling, 1-1/2-d BALDUR has been used to simulate density and temperature profiles for high and low current, neutral beam heated discharges on TFTR with several semi-empirical, theoretically-based models previously compared for TFTR, including several versions of trapped electron drift wave driven transport. Experiments at TFTR, JET and D3-D show that I_p scaling of τ_E does not arise from edge modes as previously thought, and is most likely to arise from nonlocal processes or from the I_p-dependence of local plasma core transport. Consistent with this, it is found that strong current scaling does not arise from any of several edge models of resistive ballooning. Simulations with the profile consistent drift wave model and with a new model for toroidal collisionless trapped electron mode core transport in a multimode formalism, lead to strong current scaling of τ^E for the L-mode cases on TFTR. None of the theoretically-based models succeeded in simulating the measured temperature and density profiles for both high and low current experiments.

8310 (PPPL–2802) **Comparison of measured electron density rise and calculated neutral beam particle deposition in the TFTR tokamak.** Park, H. (Princeton Univ., NJ (United States). Plasma Physics Lab.); Budny, R.; McCune, D.; Taylor, G.; Zarnstorff, M.C.; Barnes, C.W. Princeton Univ., NJ (United States). Plasma Physics Lab. Dec 1991. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03073. Order Number DE92005131. Source: OSTI; NTIS; INIS; GPO Dep.

The initial rate of rise of the central electron density during ~100 keV deuterium neutral beam injection is found to agree well with calculations of the beam deposition rate. The best agreement is with beam deposition calculations using older tabulations of the atomic cross-sections; the effects of using new tabulations or including multi-step ionization processes appear to approximately cancel. The neutral-beam deposition profile is a strong function of both the magnitude and the shape of the target plasma density. Peaked heating profiles can be achieved at high target densities only from peaked target density profiles. 15 refs., 4 figs.

8311 (PPPL–2808) **Simulations of DT experiments in TFTR.** Budny, R.; Bell, M.G.; Biglari, H.; Bitter, M.; Bush, C.; Cheng, C.Z.; Fredrickson, E.; Grek, B.; Hill, K.W.; Hsuan, H.; Janos, A.; Jassby, D.L.; Johnson, D.; Johnson, L.C.; LeBlanc, B.; McCune, D.C.; Mikkelsen, D.R.; Park, H.; Ramsey, A.T.; Sabbagh, S.A.;Princeton Univ., NJ (United States). Plasma Physics Lab. Dec 1991. 62p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03073. Order Number DE92005132. Source: OSTI; NTIS; INIS; GPO Dep.

A transport code (TRANSP) is used to simulate future deuterium-tritium experiments (DT) in TFTR. The simulations are derived from 14 TFTR DD discharges, and the modeling of one supershot is discussed in detail to indicate the degree of accuracy of the TRANSP modeling. Fusion energy yields and α-particle parameters are calculated, including profiles of the α slowing down time, average energy, and of the Alfven speed and frequency. Two types of simulations are discussed. The main emphasis is on the DT equivalent, where an equal mix of D and T is substituted for the D in the initial target plasma, and for the D^O in the neutral-beam injection, but the other measured beam and plasma parameters are unchanged. This simulation does not assume that α heating will enhance the plasma parameters, or that confinement will increase with T. The maximum relative fusion yield calculated for these simulations is $Q_{DT} \approx 0.3$, and the maximum α contribution to the central toroidal β is $\beta_\alpha(0) \approx 0.5\%$. The stability of toroidicity-induced Alfven eigenmodes (TAE) and kinetic ballooning modes (KBM) is discussed. The TAE mode is predicted to become unstable for some of the equivalent simulations, particularly after the termination of neutral beam injection. In the second type of simulation, empirical supershot scaling relations are used to project the performance at the maximum expected beam power. The MHD stability of the simulations is discussed.

8312 (TRITA-PFU–90-13) **Electron plasma oscillations at arbitrary Debye lengths.** Lehnert, B. Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research. Dec 1990. 22p. Order Number DE92614472. Source: OSTI; NTIS (US Sales Only); INIS.

A solution is presented for electron plasma oscillation in a thermalized homogeneous plasma, at arbitrary ratios between the Debye length λ_D and the perturbation wave length λ. The limit $\lambda_D << \lambda$ corresponds to conventional fluid-like theory of small particle excursions, whereas $\lambda_D >> \lambda$ corresponds to the free-streaming limit of strong kinetic phase-mixing due to large particle excursions. A strong large Debye distance (LDD) effect already appears when $\lambda_D >$ approx λ. The initial amplitude of the fluid-like contribution to the macroscopic density perturbation then becomes small as compared to the contribution from the free-streaming part. As a consequence, only a small fraction of the density perturbation remains after a limited number of kinetic damping times of the free-streaming part. The analysis further shows that a representation in terms of normal model of the form $\exp(-i\omega t)$ leads to amplitude factors of these modes which are related to each other and which depend on the combined free-streaming and fluid behaviour of the plasma. Consequently, these modes are coupled and cannot be treated as being independent of each other. (au).

8313 (TRITA-PFU–91-05) **Neutron time-of-flight counters and spectrometers for diagnostics of burning fusion plasmas.** Elevant, T.; Olsson, M. Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research. Feb 1991. 44p. Order Number DE92614452. Source: OSTI; NTIS (US Sales Only); INIS.

Experiment with burning fusion plasmas in tokamaks will place particular requirements on neutron measurements from radiation resistance-, physics-, burn control- and reliability considerations. The possibility to meet these needs by measurements of neutron fluxes and energy spectra by means of time-of-flight techniques are described. Reference counters and spectrometers are proposed and characterized with respect to efficiency, count-rate capabilities, energy resolution and tolerable neutron and γ-radiation background levels. The instruments can be used in a neutron camera and are capable to operate in collimated neutron fluxes up to levels corresponding to full nuclear output power in the next generation of experiments. Energy resolutions of the spectrometers enables determination of ion temperatures from 3 (keV) through analysis of the Doppler broadening. Primarily, the instruments are aimed for studies of 14 (MeV) neutrons produced in (d,t)-plasmas but can, after minor modifications, be used for analysis of 2.45 (MeV) neutrons produced in (d,d)-plasma. (au) (33 refs.).

8314 (TRITA-PFU–91-06) **Pre-study of burn control in Tokamak reactor experiments.** Elevant, T. (Chalmers Univ. of Technology, Goeteborg (Sweden). Inst. of Electromagnetic Field Theory and Plasma Physics); Anderson, D.; Hamnen, H.; Lisak, M.; Persson, H. Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research. Apr 1991. 137p. Order Number DE92614440. Source: OSTI; NTIS (US Sales Only); INIS.

Findings from a general study of issues associated with control of burning fusion plasmas are reported, and applications to ITER are given. A number of control variables are discussed. A zerodimensional system has been developed and stability against coupled temperature and density variations are studied. Also space dependent energy balance and transition to thermonuclear burn are analysed as well as maximum obtainable Q-values under subignited operation conditions. Control designs with different input-output strategies are analysed and numerically simulated, and a numerical experiment of system identification is made. Requirements on diagnostics are discussed and areas for further studies are identified. (au) (64 refs.).

8315 (TRITA-PFU-91-07) **A time-of-flight neutron spectrometer for DT-plasma diagnostics.** Olsson, M.; Elevant, T. Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research. Jun 1991. 52p. Order Number DE92614453. Source: OSTI; NTIS (US Sales Only); INIS.

A neutron time-of-flight spectrometer is proposed for spectral measurements of 14 MeV neutrons, generated in deuterium plasma through consecutive d(d,t)p and $d(t,n)\alpha$ reactions, i.e. minority d-t neutrons. According to numerical simulations, spectral width, average energy and fluxes of neutrons depend on confinement and slowing down of the tritons in which the electron temperature plays a significant role. Neutrons, backscattered in a deuterated first scintillator are detected in a second hydrogen based scintillator. Laboratory tests, with an efficiency of 8×10^{-6} cm^2 provide a resolution equal to 2.2%, which scales reciprocally to the flight path length. A reference spectrometer is suggested for measurements at JET, with an efficiency of 2.7×10^{-2} cm^2 and an energy resolution better than 3%, which enables spectral measurements of 14 MeV minority neutrons in the emission interval 5×10^{13} - 10^{16} s^{-1}, provided neutron filters are utilized. An upgraded version of the device, aimed for spectral measurements of 14 MeV neutrons from DT-plasmas, is suggested. In this case the resolution is 2.0% and the maximum efficiency 2.9×10^{-3} cm^2. (au).

8316 (TRITA-PFU-91-08) **Visible spectroscopy at the Extrap-T1 pinch experiment.** Bengtsson, P. (Lund University, (Sweden). Dept. of Physics); Brzozowski, J.H.; Kaellne, E.; Zaztrow, K.D. Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research. Jun 1991. 59p. Order Number DE92614460. Source: OSTI; NTIS (US Sales Only); INIS.

A wide range UV to visible spectrum from 2450 to 8050 Angstrom has been acquired and analysed for the EXTRAP-T1 plasma. The impurity lines in the spectrum are mainly from carbon and oxygen species up to four times ionized, but also nitrogen lines are present. No traces of metal impurity are observed. We have identified most of the spectral lines and compare intensities from several multiplets with predicted values. A spectral range free from line emission is found which is suitable for continuum measurements. Furthermore, line strictures are identified as originating from the CH molecule and are observed both using a center chord line of sight and an edge chord line-of-sight through the plasma. (au).

8317 (UCRL-JC-107675) **Measurements and models of the opacity of hot, dense plasma.** Springer, P.T.; Perry, T.S.; Fields, D.F.; Goldstein, W.H.; Wilson, B.G.; Stewart, R.E. Lawrence Livermore National Lab., CA (United States). Aug 1991. 8p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9108105-4: 8. topical conference on atomic processes in plasmas, Portland, ME (United States), 25-29 Aug 1991). Order Number DE92004654. Source: OSTI; NTIS; GPO Dep.

In order to test and improve opacity models, we are performing experiments to accurately characterize and measure the opacity of high-Z plasmas. In the experiments the NOVA laser at Lawrence Livermore National Laboratory is used to indirectly heat tamped thin foil targets containing mid to high-Z ions of interest which are co-mixed with low-Z ions for spectroscopic determinations of plasma conditions. One of the NOVA beams is used to create a source of x-rays of backlighting the plasma face-on, while another beam is used to perform a radiograph of the expanding sample edge-on. X-rays that pass through and around the plasma are simultaneously measured on high resolution crystal spectrometers, and the opacity is measured by comparing the direct and attenuated x-ray spectra. Plasma density is determined from the spatial extent of the expanded plasma, and plasma temperature is inferred from the ionization distribution of the low-Z ions doped in the plasma. Predictions of the high-Z opacity are then compared with data using measured conditions as input. These are the first high temperature opacity measurements in which samples conditions are simultaneously determined. We present measurements and predictions for a spectroscopic experiment using a comixture of aluminum and niobium. We discuss plans for future improvements, and for spectroscopic measurements in the spectral region determining Rosseland mean opacities. 5 refs., 6 figs.

8318 (UW-CPTC-91-18) **Transport processes in magnetically confined plasmas.** Callen, J.D. Wisconsin Univ., Madison, WI (United States). Dec 1991. 41p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER53218. (CONF-9111127-4: 33. annual Division of Plasma Physics/American Physical Society (DPP/APS) meeting, Tampa, FL (United States), 4-8 Nov 1991). Order Number DE92004746. Source: OSTI; NTIS; INIS; GPO Dep.

Intensified studies of plasma transport in toroidal plasmas over the past three to five years have progressed through increased understanding in some areas and changed perceptions about the most important issues in other areas. Recent developments are reviewed for six selected topics: edge fluctuations and transport; L-H mode transition; core fluctuations; modern plasma turbulence theory; transient transport; and global scaling. Some of the developments that are highlighted include: the role of a strongly sheared poloidal flow in edge plasma turbulence, transport and the L-H transition; change of focus from $\kappa_\perp \rho_s \sim 1$ to $\kappa_\perp \rho_s \ll 1$ fluctuations in tokamak plasmas; modern Direct-Interaction-Approximation plasma turbulence and hybrid fluid/kinetic theoretical models; and transient transport experiments that are raising fundamental questions about our conceptions of local transport processes in tokamaks. 104 refs., 6 figs.

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Refer also to citation(s) 6936, 7023, 7031, 7037, 8230, 8242, 8244, 8245, 8252, 8256, 8257, 8293, 8298, 8317, 8419

8319 (ANL/CP-70626) **Activation analyses for different fusion structural alloys.** Attaya, H.; Smith, D. Argonne National Lab., IL (United States). [1991]. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-911111-13: International conference on fusion reactor materials, Clearwater, FL (United States), 17-22 Nov 1991). Order Number DE92004143. Source: OSTI; NTIS; INIS; GPO Dep.

The leading candidate structural materials, viz., the vanadium alloys, the nickel or the manganese stabilized austenitic steels, and the ferritic steels, are analysed in terms of their induced activation in the TPSS fusion power reactor. The TPSS reactor has 1950 MW fusion power and inboard and outboard average neutron wall loading of 3.75 and 5.35 MW/m^2 respectively. The results shows that, after one year of continuous operation, the vanadium alloys have the least radioactivity at reactor shutdown. The maximum difference between the induced radioactivity in the vanadium alloys and in the other iron-based alloys occurs at about 10 years after reactor shutdown. At this time, the total reactor radioactivity, using the vanadium alloys, is about two orders of magnitude less than the total reactor radioactivity utilizing any other alloy. The difference is even larger in the first wall, the FW-vanadium activation is 3 orders of magnitude less than other alloys' FW activation. 2 refs., 7 figs.

8320 (ANL/CP-72699) **Tritium production, management and its impact on safety for a D-^{3}He fusion reactor.** Sze, D.K. (Argonne National Lab., IL (United States)); Herring, S.; Sawan, M. Argonne National Lab., IL (United States). Nov 1991. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-910920-8: 4. topical meeting on tritium technology in fission, fusion, and isotopic applications, Albuquerque, NM (United States), 30 Sep - 4 oct 1991). Order Number DE92004144. Source: OSTI; NTIS; INIS; GPO Dep.

About three percent of the fusion energy produced by a D-^{3}He reactor is in the form of neutrons. Those neutrons are generated by D-D and D-T reactions, with the tritium produced by the D-D fusion. The neutrons will react with structural steel, deuterium, ^{3}He and shielding material to produce tritium. About half of the tritium generated by the D-D reaction will not burn in the plasma and will exit as a part of the plasma exhaust. Thus, there is enough tritium produced in a D-^{3}He reactor and careful management will be required. The tritium produced in the shield and plasma can be managed with an acceptable effect on cost and safety. 3 refs., 2 figs., 3 tabs.

8321 (ANL/CP--72824) **Analysis of sweeping heat loads on divertor plate materials.** Hassanein, A. Argonne National Lab., IL (United States). [1991]. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-911111--12: International conference on fusion reactor materials, Clearwater, FL (United States), 17-22 Nov 1991). Order Number DE92004145. Source: OSTI; NTIS; INIS; GPO Dep.

The heat flux on the divertor plate of a fusion reactor is probably one of the most limiting constraints on its lifetime. The current heat flux profile on the outer divertor plate of a device like ITER is highly peaked with narrow profile. The peak heat flux can be as high as 30--40 MW/m^2 with full width at half maximum (FWHM) is in the order of a few centimeters. Sweeping the separatrix along the divertor plate is one of the options proposed to reduce the thermomechanical effects of this highly peaked narrow profile distribution. The effectiveness of the sweeping process is investigated parametrically for various design values. The optimum sweeping parameters of a particular heat load will depend on the design of the divertor plate as well as on the profile of such a heat load. In general, moving a highly peaked heat load results in substantial reduction of the thermomechanical effects on the divertor plate. 3 refs., 8 figs.

8322 (ANL/CP--72828) **Thermal response of substrate structural materials during a plasma disruption.** Hassanein, A.; Smith, D.L. Argonne National Lab., IL (United States). [1991]. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-911111--10: International conference on fusion reactor materials, Clearwater, FL (United States), 17-22 Nov 1991). Order Number DE92004147. Source: OSTI; NTIS; INIS; GPO Dep.

Intense energy fluxes to in-vessel components like the first wall and the divertor plate of a fusion reactor are expected during plasma disruptions. This high energy deposition in short times may cause severe surface erosion of these components resulting from melting and vaporization. Coatings and tile materials are proposed to protect and maintain the integrity of the underneath structural materials from both erosion losses as well as from high thermal stresses encountered during a disruption. The coating thickness should be large enough to withstand both erosion losses and to reduce the temperature rise in the substrate structural material. Yet the coating thickness should be minimized to reduce potential problems from radioactivity, toxicity, and plasma contamination. Tile materials such as graphite and coating materials such as tungsten and beryllium on structural materials like copper and steel are analyzed as potential divertor and first wall design options. The disruption is assumed to be composed of two phases: a thermal quench phase followed by a current quench phase. The minimum coating thickness required to protect the structural material is discussed for range of disruption parameters. 7 refs., 8 figs.

8323 (ANL/CP--72864) **Tritium transport in lithium ceramics porous media.** Tam, S.W.; Ambrose, V. Argonne National Lab., IL (United States). [1991]. 19p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-911111--11: International conference on fusion reactor materials, Clearwater, FL (United States), 17-22 Nov 1991). Order Number DE92004146. Source: OSTI; NTIS; INIS; GPO Dep.

A random network model has been utilized to analyze the problem of tritium percolation through porous Li ceramic breeders. Local transport in each pore channel is described by a set of convection-diffusion-reaction equations. Long range transport is described by a matrix technique. The heterogeneous structure of the porous medium is accounted for via Monte Carlo methods. The model was then applied to an analysis of the relative contribution of diffusion and convective flow to tritium transport in porous lithium ceramics. 15 refs., 4 figs.

8324 (ANL/CP--74797) **Measured fast-neutron activation cross sections of Ag, Cu, Eu, Fe, Hf, Ni, Tb and Ti at 10.3 and 14.8 MeV and for the continuum neutron spectrum produced by 7-MeV deuterons on a thick Be-metal target.** Meadows, J.W. (Argonne National Lab., IL (United States)); Smith, D.L.; Greenwood, L.R.; Haight, R.C.; Ikeda, Y.; Konno, C. Argonne National Lab., IL (United States). [1991]. 22p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38 ;W-7405-ENG-36. (CONF-9110261--3: International Nuclear Energy Agency nuclear data committee meeting, Karlsruhe (Germany), 19-26 Oct 1991). Order Number DE92003999. Source: OSTI; NTIS; INIS; GPO Dep.

Four identical sample packets containing elemental Ag, Cu, Eu, Fe, Hf, Ni, Tb and Ti have been irradiated in three distinct accelerator neutron fields, at Argonne National Laboratory and Los Alamos National Laboratory, USA, and Japan Atomic Energy Research Institute, Tokai, Japan, under the auspices of an International Atomic Energy Agency Coordinated Research Program to investigate the production of long-lived radionuclides for fusion waste disposal applications. Final experimental results are presented here for 13 distinct reactions which ultimately lead to production of the following activities: Ag-106m,108m; Co-60g; Cr-51; Eu-150g, -152g; Hf-175,-179m2; Mn-54; Sc-46g,-47,-48; Tb-158g. The neutron fluence standard used was Ni-58(n,p)Co-58. The measured data include differential cross section values at 10.3 and 14.8 MeV, and integral cross sections for the continuum neutron spectrum produced by 7-MeV deuterons incident on a thick Be-metal target. The U-238(n,f) cross section was also measured at 10.3 MeV as a consistency check on the experimental technique. Some of the results of this study are compared with corresponding values from earlier work at Argonne and from ENDF/B-6. 134 refs., 1 fig., 9 tabs.

8325 (ANL/FPP/TM--257) **The measurement of gamma ray induced heating in a mixed neutron and gamma ray environment.** Chiu, H.K. Argonne National Lab., IL (United States). Oct 1991. 166p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. Order Number DE92006457. Source: OSTI; NTIS; INIS; GPO Dep.

The problem of measuring the gamma heating in a mixed DT neutron and gamma ray environment was explored. A new detector technique was developed to make this measurement. Gamma heating measurements were made in a low-Z assembly irradiated with 14-Mev neutrons and (n, n′) gammas produced by a Texas Nuclear Model 9400 neutron generator. Heating measurements were made in the mid-line of the lattice using a proportional counter operating in the Continuously-varied Bias-voltage Acquisition mode. The neutron-induced signal was separated from the gamma-induced signal by exploiting the signal rise-time differences inherent to radiations of different linear energy transfer coefficient, which are observable in a proportional counter. The operating limits of this measurement technique were explored by varying the counter position in the low-Z lattice, hence changing the irradiation spectrum observed. The experiment was modelled numerically to help interpret the measured results. The transport of neutrons and gamma rays in the assembly was modelled using the one- dimensional radiation transport code ANISN/PC. The cross-section set used for these calculations was derived from the ENDF/B-V library using the code MC^2-2 for the case of DT neutrons slowing down in a low-Z material. The calculated neutron and gamma spectra in the slab and the relevant mass-stopping powers were used to construct weighting factors which relate the energy deposition in the counter fill-gas to that in the counter wall and in the surrounding material. The gamma energy deposition at various positions in the lattice is estimated by applying these weighting factors to the measured gamma energy deposition in the counter at those locations.

8326 (CONF-911111--18) **The effect of neutron irradiation on the structure and properties of carbon-carbon composite materials.** Burchell, T.D.; Eatherly, W.P.; Robbins, J.M.; Strizak, J.P. Oak Ridge National Lab., TN (United States). [1991]. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From International conference on fusion reactor materials; Clearwater, FL (United States); 17-22 Nov 1991. Order Number DE92005121. Source: OSTI; NTIS; INIS; GPO Dep.

Carbon-based materials are an attractive choice for fusion reactor plasma facing components (PFCs) because of their low atomic number, superior thermal shock resistance, and low neutron activation. Next generation plasma fusion reactors, such as the International Thermonuclear Experimental Reactor (ITER), will require advanced carbon-carbon composite materials possessing extremely high thermal conductivity to manage the anticipated severe heat loads. Moreover, ignition machines such as ITER will produce high neutron fluxes. Consequently, the influence of neutron damage on the structure and properties of carbon-carbon composite materials must be evaluated. Data from an irradiation experiment are reported and discussed here. Fusion relevant graphite and carbon-carbon composites were irradiated in a target capsule in the High Flux Isotope Reactor (HFIR) at Oak Ridge National Laboratory (ORNL). A peak damage dose of 1.59 dpa at 600°C was attained. The carbon materials irradiated included nuclear graphite grade H-451 and one-, two-, and three-directional carbon-carbon composite materials. Dimensional changes, thermal conductivity and strength are reported for the materials examined. The influence of fiber type, architecture, and heat treatment temperature on properties and irradiation behavior are reported. Carbon-Carbon composite dimensional changes are interpreted in terms of simple microstructural models.

8327 (DOE/ER/52111–3) **Application of railgun principle to high-velocity hydrogen pellet injection for magnetic fusion reactor refueling: Technical progress report, [July 16, 1990–August 16, 1991].** Kim, K. Illinois Univ., Urbana, IL (United States). Dept. of Electrical and Computer Engineering. Aug 1991. 204p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-84ER52111. Order Number DE92004202. Source: OSTI; NTIS; INIS; GPO Dep.

This report contains three documents describing the progress made by the University of Illinois electromagnetic railgun program sponsored by the Office of Fusion Energy of the United States Department of Energy during the period from July 16, 1990 to August 16, 1991. The first document contains a brief summary of the tasks initiated, continued, or completed, the status of major tasks, and the research effort distribution, estimated and actual, during the period. The second document contains a description of the work performed on time resolved laser interferometric density measurement of the railgun plasma-arc armature. The third document is an account of research on the spectroscopic measurement of the electron density and temperature of the railgun plasma arc.

8328 (DOE/ER/52143–T1) **Damage analysis and fundamental studies for fusion reactor materials development: Progress report, December 1, 1986–December 31, 1990.** Odette, G.R.; Lucas, G.E. California Univ., Santa Barbara, CA (United States). Dept. of Chemical and Nuclear Engineering. Sep 1991. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract FG03-87ER52143. Order Number DE92004308. Source: OSTI; NTIS; INIS; GPO Dep.

The philosophy of the program at the University of California Santa Barbara has been to develop a fundamental understanding of both the basic damage processes and microstructural evolution that take place in a material during neutron irradiation and the consequent dimensional and mechanical property changes. This fundamental understanding can be used in conjunction with empirical data obtained from a variety of irradiation facilities to develop physically-based models of neutron irradiation effects in structural materials. The models in turn can be used to guide alloy development and to help extrapolate the irradiation data base (expected to be largely fission reactor based) to the fusion reactor regime. This philosophy is consistent with that of the national and international programs for developing structural materials for fusion reactors.

8329 (DOE/ER/52154–T4) **Code development incorporating environmental, safety, and economic aspects of fusion reactors (FY 89–91): Final report.** Ho, S.K.; Fowler, T.K.; Holdren, J.P. (eds.). California Univ., Berkeley, CA (United States). Berkeley Fusion Engineering. Nov 1991. 167p. Sponsored by U.S. DOE Energy Research. DOE Contract FG03-89ER52154. (UC-BFE–027). Order Number DE92004060. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the following aspects of Fusion reactors.: Activation Analysis; Tritium Inventory; Environmental and Safety Indices and Their Graphical Representation; Probabilistic Risk Assessment (PRA) and Decision Analysis; Plasma Burn Control – Application to ITER; and Other Applications.

8330 (DOE/ER/53222–106) **The neutral hydrogen beam experiment in the Columbia High Beta Tokamak "HBT": Part 1, The design of the beam system: Part 2, The orbit simulation of fast ions.** Wang, Jian-Hua; Marshall, T.C. Columbia Univ., New York, NY (United States). Plasma Physics Lab. 1991. 99p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER53222. Order Number DE92003987. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the design of the beam system and the orbit simulation of fast ions in the Columbia High Beat Tokamak. (LSP).

8331 (DOE/ER/53264–1) **Experimental investigations of ICRF effects: Annual performance report, November 1990–June 1991.** Wisconsin Univ., Madison, WI (United States). Phaedrus Lab. for Plasma Science. [1991]. 30p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER53264. Order Number DE92004396. Source: OSTI; NTIS; INIS; GPO Dep.

The goal of the Phaedrus program is to establish the relative efficiency of helicity and momentum current drive for rf near and below omega$_{ci}$ and compare to theory. This paper discusses major accomplishments in the rf program; extension of operating parameters; facility improvements; and additional experimental activities. (LSP)

8332 (ECN-C–91-018) **Measurements of ac losses in NET prototype OH conductors.** Eikelboom, J.A. Netherlands Energy Research Foundation, Petten (Netherlands). Mar 1991. 29p. Contract no. 351/88-12/FU-NL(NET No.88-186). Order Number DE92614526. Source: OSTI; NTIS (US Sales Only); INIS.

This work has been performed under NET Contract during the period March 1989 and January 1991.

Ac loss measurements have been performed in samples of a prototype conductor being developed for application in the central solenoid of NET. Two types of losses have been measured: hysteresis losses in the strand, and coupling losses in the strand, subcables and full size conductor. (H.W.). 1 ref.; 12 figs.; 17 tabs.

8333 (ENEA-RT-NUCL–90-04, pp. 41-44) **Equilibrium beta limit and alpha particle containment in stellarators as function of their aspect ratio.** Alladio, F.; Batistoni, P.; Crisanti, F.; Mancuso, S. ENEA, Frascati (Italy). Area Nucleare. 1990. (CONF-900602–: 17. European Physical Society (EPS) conference on controlled fusion and plasma heating, Amsterdam (Netherlands), 25-29 Jun 1990). In *Contributions to 17th EPS conference on controlled fusion and plasma heating.* 60p. Order Number DE92743986. Source: OSTI; NTIS (US Sales Only).

From 17th EPS conference on controlled fusion and plasma heating; Amsterdam, Netherlands (25-29 Jun 1990).

The possibility of designing stellarator or torsatron configurations at low aspect ratio remains and ambitious goal. The advantages of such an approach are the high use of the magnetic field volume, the reduced space taken by the winding and the computed equilibrium and ideal stability high beta limit, whereas the disadvantages are the increased fast particle losses. The choice of the winding law for the helicoidal coils is certainly the most critical tool for maximizing the advantages and minimizing the disadvantages. The choice of winding the helicoidal currents on circular cross-section tori with constant pitch in toroidal coordinates has turned out to be a rewarding one. It allows a fully analytical treatment of the 1-D vacuum fields and permits easy access to low aspect ratio configurations. This paper attempts a systematic scan in the aspect ratio of idealized stellarators, with fixed poloidal (m=2) number and 5T toroidal field at $R=R_0=2m$ (concentration point of the toroidal coordinates); the helicoidal currents are surface currents flowing with costant pitch in toroidal coordinates on circular cross-section tori of major and minor radius.

8334 (ENEA-RT-NUCL–90-15) **ENEA-Frascati inertial confinement fusion: Multi-channel digitizer control, acquisition and analysis system.** Caruso, A.; Strangio, C.; Elman, G.; Hugh, J. Mc; Rogers, G.; Pastina, E.; Raimondi, F.; Umbro, A. ENEA, Frascati (Italy). Area Nucleare. Sep 1991. 85p. (RT/NUCL–90-15). Order Number DE92743981. Source: OSTI; NTIS (US Sales Only).

The ICF (Inertial Confinement Fusion) data acquisition and analysis system described in this paper incorporates digitizer channels, signal switching, an instrument controller, a graphic hardcopy unit, laser printer and software. The digitizers, signal switching and instrument controller are standard components appropriate to acquire the single fast shot signals (rise-time: from about 100 picoseconds to nanoseconds). The input signals are switched to the digitizers through the TSI-8150 test system interface by TSS40 switch controller cards and TSS46 18GHz microwave switches. Graphic hardcopy is accomplished using either a 4693PX colour hardcopy unit or a laser printer connected through a printer spooler/ multiplexer. The software is based on an existing package from Ressler called RAI/DAC reviewed by Fus-Inerz and Tektronix-Italy to define the modifications needed for data acquisition and handling. The adopted software solution is based on an IBM PC compatible instrument controller running software developed by Ressler Associates.

8335 (ENEA-RT-NUCL–90-28) **FT Tokamak Upgrade (FTU) vacuum vessel section cleaning by glow discharge in hydrogen.** Ciotti, M.; Apicella, M.L.; Verdini, L.; Ferro, C. ENEA, Frascati (Italy). Area Nucleare. Sep 1991. 20p. (RT/NUCL–90-28). Order Number DE92744032. Source: OSTI; NTIS (US Sales Only).

The possibility of applying glow discharge in hydrogen for the cleaning of the FTU (Frascati Tokamak Upgrade) vacuum chamber was analyzed on a 1:1 scale toroidal section by using the same operating conditions as foreseen for the machine. The discharge was maintained for six hours in the chamber with the wall temperature kept at 150 degrees C. The partial pressures at the end of the cleaning run were compared with those obtained by using only thermal outgassing at the same temperature. A reduction of about a factor of two in the H_20 and $C0_2$ partial pressures was observed, related to a better cleanness of the surface. It was found that the high temperature during the glow discharge cleaning not only increases the efficiency of the discharge, but it is an efficient tool to remove impurities from the hidden regions, defined by the thermal shields that cover all the vacuum vessel walls not directly exposed to the glow discharge.

8336 (ENEA-RT-NUCL–90-36) **Rayleigh-Taylor instability on high gain target for heavy ion beam fusion.** Caruso, A.; Pais, V.A.; Parodi, A. ENEA, Frascati (Italy). Dipt. Fusione. 1991. 20p. (RT/NUCL–90-36). Order Number DE92744003. Source: OSTI; NTIS (US Sales Only).

A numerical analysis was carried out on the stability of targets designed to produce fusion energy gains close to 100 when irradiated with an appropriate heavy ion beam. To reach such performances, it was found that a high-Z radiation shield was necessary to screen the DT fuel from the radiation coming from the surrounding hot material. Since high-Z material opacity is only weakly density dependent, the analysis considered targets with lead shields both at solid density and with a density equivalent to that of the contiguous external material. The behaviour of both these kinds of targets was studied by introducing a small spatial non-uniformity on the external surface of the lead shielding. Targets with low-density shields were also tested with a beam intensity perturbation. Since density gradients were very sharp and ablation was practically absent, these implosions were found to be Rayleigh-Taylor unstable. With the use of the full hydrodynamic-radiative model with a non-linear heavy ion energy deposition and mesh correction, it was possible, to follow the evolution in the non-linear regime.

8337 (ENEA-RT-NUCL–90-41) **Superconducting coil: Use of super elements.** Della Corte, A.; Di Pietro, E. ENEA, Frascati (Italy). Dipt. Fusione. May 1991. 14p. (CONF-9005399–1: 1990 ABAQUS, New Port, RI (United States), 30 May 1990; RT/NUCL–90-41). Order Number DE92744008. Source: OSTI; NTIS (US Sales Only).

From 1990 ABAQUS; New Port, Rhode Island, USA (30 May-1 June 1990).

Within the framework of a R and D program on the possible configuration of the superconducting cable that can be used on the NET (Next European Torus), ENEA (Italian Commission for Nuclear and Alternative Energy Sources) has decided to start the project of a model coil using CICC (Cable-In-Conduit Conductors) turns. The CICC is a cable configuration (HOENIG,1985) first utilized by Westinghouse for the construction of one of the six coils of LCT (Large Coil Task). The ENEA CICC will be composed of 135 Nb3Sn strands (each of them with 19 wires) sandwiched between two Cu+CuSn stabilizing elements, clamped on a copper tube, encased in a steel jacket and filled, during operation, with supercritical helium at 4.5 K and 0.8 MPa. This paper describes the stress analysis of the superconducting coil under the effect of Lorentz forces. Due to the high number of turns (286) in the coil and the conductor complexity (geometry, materials, and loads), the analysis was performed by taking advantage of the SUPERELEMENT code option recently introduced in the 4.7 ABAQUS version. The results of this analysis are compared with the results obtained using ordinary material homogenization techniques.

8338 (ENEA-RT-NUCL–90-44) **High gain ICF implosion symmetry requirements.** Atzeni, S. ENEA, Frascati (Italy). Area Nucleare. Jun 1991. 14p. (CONF-9011184–2: 1990 international symposium on heavy ion fusion, Monterey, CA (United States), 6-9 Nov 1990; RT/NUCL–90-44). Order Number DE92744030. Source: OSTI; NTIS (US Sales Only).

From International symposium on heavy ion inertial fusion; Monterey, CA, USA (3-6 Dec 1990).

Some aspects of the problem of implosion symmetry in inertial confinement fusion (ICF) are discussed, with particular reference given to heavy ion beam fusion. The physics relative to the ignition of a target imploded by a driving pressure with long wavelength (low-mode number Legendre modes) asymmetries are studied by means of 2-D simulations. A parametric study shows that the tolerable level of non-uniformity is a decreasing function of mode number with the actual values depending on the specific target features (such as convergence ratio and ignition margin). The isobaric-fuel model of gain is then used to show how symmetry constraints (which limit the convergence ratio and the 'hohlraum' transfer efficiency) affect the fuel energy gain. By using a model of ion beam energy conversion to X-rays, the gain of a class of indirectly driven targets is also estimated as a function of the relevant beam parameters.

8339 (ENEA-RT-NUCL–90-48) **High performance, long pulse, tokamak.** Tanga, A.; Roccella, M.; Tubbing, B.J.D.; Sack, C.H.; Bosia, G.; Sborchia, C. ENEA, Frascati (Italy). Area Nucleare; Ansaldo SpA, Genoa (Italy). Research Div. Jun 1991. 61p. (RT/NUCL–90-48). Order Number DE92744029. Source: OSTI; NTIS (US Sales Only).

The key design and performance characteristics of a proposed high performance, long pulse tokamak (HLT) are described. The main parameters of the machine are: major radius, 3.4 m; minor radius, 1.2 m; elongation, 2; maximum toroidal field on axis, 8.3 T; maximum plasma current, 20 MA. The discharge flat top length is 40 s for a plasma with a 20 MA inductively driven current at a toroidal field of 8.0 T, and 500 s for a discharge with a 7 MA non-inductively driven current at a field of 3.5 T. With HLT, the main physics issues for a fusion reactor can be assessed: plasma physics and plasma operation in the ignited and sub-ignited regimes; burn stabilization; behaviour of divertor components under long-pulse thermal loads; and semi-continuous operation with non-inductive current drive. The crucial element in obtaining this level of performance in a machine of medium size is the use of active cooling with liquid nitrogen both for the toroidal field coils and the central solenoid. The toroidal field coils have a pure copper conductor in a stainless steel casing. The stress in the copper does not exceed a relatively conservative limit of 180 MPa.

8340 (GA-A–20570) **DIII-D radiation shielding procedures and experiences.** Taylor, P.L. General Atomics, San Diego, CA (United States). Nov 1991. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-89ER51114. (CONF-910968–49: 14. IEEE symposium on fusion engineering, San Diego, CA (United States), 30 Sep - 3 oct 1991). Order Number DE92004296. Source: OSTI; NTIS; INIS; GPO Dep.

The D3-D tokamak operates with a neutron radiation shield to allow enhanced plasma operations with increased neutron production while minimizing the site boundary dose level. Neutron rates as high as 4×10^{15} neutrons/s and total neutron production as high as 4 x 10^{15} neutrons per shot are obtained while maintaining the site dose below the DOE administrative level of 20 mrem per year; a much more restrictive level than the State of California radiation limits. The radiation shielding has increased by a factor of 300 over the preshield value and is in agreement with the design calculation. The maximum site neutron dose since installation of the shield has been less than 0.03 mrem for a shot and less than 0.4 mrem for a day. The site neutron and gamma dose are monitored continuously during operations by a PC-based computer system that provides the means of measuring the low dose levels that occur during a shot by including postshot background subtraction. The neutron and gamma dose are measured and archived by shot, hour, and day in a database. Activation of the machine after a run day and during vessel entries is monitored and the activated nuclides have been determined. A radiation monitoring program and procedures are used to control the exposures to facility personnel and the exposure at the site boundary.

8341 (GA-A–20587) **Optimization of thermal design for nitrogen shield of JET cryopump.** Baxi, C.B. (General Atomics, San Diego, CA (United States)); Obert, W. General Atomics, San Diego, CA (United States). Nov 1991. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-89ER51114. (CONF-910968–50: 14. IEEE symposium on fusion engineering, San Diego, CA (United States), 30 Sep - 3 oct 1991). Order Number DE92004295. Source: OSTI; NTIS; INIS; GPO Dep.

The reference design of JET cryopump nitrogen shield consists of an outer section made of copper chevrons fastened to two cooling tubes and an inner stainless steel section and backing plate with two cooling tubes. These tubes are fed in a parallel flow arrangement. The inlet flow is divided into two parallel paths so that both tubes on either section are always at the same temperature. This arrangement was selected due to concern about conduction between warm and cold parts of the shield during cooldown transients. If the heat loads are unequal, such a parallel flow arrangement can result in flow starvation in the path with higher heat load. This will cause large temperature differences and, ultimately, structural failure. Hence, an analysis was undertaken to investigate the conduction effects in the shield for other flow arrangements. 4 refs., 8 figs.

8342 (GA-A–20607) **Design of the advanced divertor pump cryogenic system for DIII-D.** Schaubel, K.M. (General Atomics, San Diego, CA (United States)); Baxi, C.B.; Campbell, G.L.; Gootgeld, A.M.; Langhorn, A.R.; Laughon, G.J.; Smith, J.P.; Anderson, P.M.; Menon, M.M. General Atomics, San Diego, CA (United States). Nov 1991. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-89ER51114. (CONF-910968–53: 14. IEEE symposium on fusion engineering, San Diego, CA (United States), 30 Sep - 3 oct 1991). Order Number DE92004288. Source: OSTI; NTIS; INIS; GPO Dep.

The design of the cryogenic system for the D3-D advanced divertor cryocondensation pump is presented. The advanced divertor incorporates a baffle chamber and bias ring located near the bottom of the D3-D vacuum vessel. A 50,000 l/s cryocondensation pump will be installed underneath the baffle for plasma particle exhaust. The pump consists of a liquid helium cooled tube operating at 4.3°K and a liquid nitrogen cooled radiation shield. Liquid helium is fed by forced flow through the cryopump. Compressed helium gas flowing through the high pressure side of a heat exchanger is regeneratively cooled by the two-phase helium leaving the pump. The cooled high pressure gaseous helium is than liquefied by a Joule-Thomson expansion valve. The liquid is returned to a storage dewar. The liquid nitrogen for the radiation shield is supplied by forced flow from a bulk storage system. Control of the cryogenic system is accomplished by a programmable logic controller.

8343 (GA-A–20617) **Glow discharge initiation with electron gun assist.** Holtrop, K.L.; Jackson, G.L.; Schaubel, K.M.; Kellman, A.G. General Atomics, San Diego, CA (United States). Nov 1991. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-89ER51114. (CONF-910968–55: 14. IEEE symposium on fusion engineering, San Diego, CA (United States), 30 Sep - 3 oct 1991). Order Number DE92005437. Source: OSTI; NTIS; INIS; GPO Dep.

Helium glow discharge conditioning is used before every discharge in the D3-D Tokamak to desorb hydrogen and low Z impurities from the graphite and Inconel plasma facing surfaces. However high gas pressure is required to initiate each glow discharge session and this requires frequent cycling of valves to protect pressure sensitive devices. To alleviate this mechanical fatigue an electron gun assisted glow system (EAG) is being installed on the D3-D vessel to lower the initiation pressure. Through the injection of electrons the initiation pressure of the helium glow discharge has been lowered by a factor of 70, bringing the initiation pressure within a factor of 2 of the minimum sustaining pressure of the glow discharge. This might also make possible pulsed glow conditioning which would allow a lower average pressure during glow conditioning reducing the heat load on proposed cryogenic pumping panels. Experimental results of the electron assist on He glow initiation and a scaling model for the electron gun assisted glow will be presented. The electron gun can also be used as a diagnostic. Without a glow discharge, the electron gun has been pulsed into the wall and desorbed gas measured by a Residual Gas Analyzer. We are attempting to correlate the desorbed gas with recycling or vessel cleanliness.

8344 (GA-A–20632) **110 GHz ECH on DIII-D: System overview and initial operation.** Cary, W.P.; Allen, J.C.; Callis, R.W.; Doane, J.L.; Harris, T.E.; Moeller, C.P.; Nerem, A.; Prater, R.; Remsen, D. General Atomics, San Diego, CA (United States). Nov 1991. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-89ER51114. (CONF-910968–52: 14. IEEE symposium on fusion engineering, San Diego, CA (United States), 30 Sep - 3 oct 1991). Order Number DE92004293. Source: OSTI; NTIS; INIS; GPO Dep.

A new high power electron cyclotron heating (ECH) system has been introduced on D3-D. This system is designed to operate at 110 GHz with a total output power of 2 MW. The system consists of four Varian VGT-8011 gyrotrons, (output power of 500 kW), and their associated support equipment. All components have been designed for up to a 10 second pulse duration. The 110 GHz system is intended to further progress in rf current drive experiments on D3-D when used in conjunction with the existing 60 GHz ECH (1.6 MW), and the 30–60 MHz ICH (2 MW) systems. H-mode physics, plasma stabilization experiments and transport studies are also to be conducted at 110 GHz. The present system design philosophy was based on experience gained from the existing 60 GHz ECH system. The consequences of these design decisions will be addressed as will the actual performance of various 110 GHz components.

8345 (GA-A–20636) **Modeling and measurement of the motion of the DIII-D vacuum vessel during vertical instabilities.** Reis, E.; Blevins, R.D.; Jensen, T.H.; Luxon, J.L.; Petersen, P.I.; Strait, E.J. General Atomics, San Diego, CA (United States). Nov 1991. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-89ER51114. (CONF-910968–48: 14. IEEE symposium on fusion engineering, San Diego, CA (United States), 30 Sep - 3 oct 1991). Order Number DE92004044. Source: OSTI; NTIS; INIS; GPO Dep.

The motions of the D3-D vacuum vessel during vertical instabilities of elongated plasmas have been measured and studied over the past five years. The currents flowing in the vessel wall and the plasma scrapeoff layer were also measured and correlated to a physics model. These results provide a time history load distribution on the vessel which were input to a dynamic analysis for correlation to the measured motions. The structural model of the vessel using the loads developed from the measured vessel currents showed that the calculated displacement history correlated well with the measured values. The dynamic analysis provides a good estimate of the stresses and the maximum allowable deflection of the vessel. In addition, the vessel motions produce acoustic emissions at 21 Hertz that are sufficiently loud to be felt as well as heard by the D3-D operators. Time history measurements of the sounds were correlated to the vessel displacements. An analytical model of an oscillating sphere provided a reasonable correlation to the amplitude of the measured sounds. The correlation of the theoretical and measured vessel currents, the dynamic measurements and analysis, and the acoustic measurements and analysis show that: (1) The physics model can predict vessel forces for selected values of plasma resistivity. The model also predicts poloidal and toroidal wall currents which agree with measured values; (2) The force-time history from the above model, used in conjunction with an axisymmetric structural model of the vessel, predicts vessel motions which agree well with measured values; (3) The above results, input to a simple acoustic model predicts the magnitude of sounds emitted from the vessel during disruptions which agree with acoustic measurements; (4) Correlation of measured vessel motions with structural analysis shows that a maximum vertical motion of the vessel up to 0.24 in will not overstress the vessel or its supports. 11 refs., 10 figs., 1 tab.

8346 (GA-A–20750) **Initial boronization of the DIII-D tokamak.** Phillips, J.; Hodapp, T.; Holtrop, K.; Jackson, G.; Winter, J. General Atomics, San Diego, CA (United States). Oct 1991. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-89ER51114. (CONF-911132–9: 38. national symposium of the American Vacuum Society, Seattle, WA (United States), 11-15 Nov 1991). Order Number DE92004457. Source: OSTI; NTIS; INIS; GPO Dep.

A system has been installed to deposit a thin film of elemental boron to the walls of the D3-D tokamak, in order to reduce the influx of impurities during plasma discharges. Subsequently new regimes of substantially tokamak energy confinement were obtained. The deposition of the boron layer is achieved during a glow-discharge session using a helium-diborane age mixture and a film of $\approx$100 nm is deposited. The boronization system includes special storage and handling precautions for the diborane, a delivery and metering system for the glow-discharge, modifications to the tokamak's residual gas analyzer system, and a dedicated system for handling and neutralizing the exhaust gas from the tokamak. Tokamak discharges with similar parameters before and after boronization are used to characterize the effects of the boron film. Nickel has been reduced by a factor of 30, while impurities such as oxygen and carbon are reduced fivefold. A system of pulsing the flow discharge has been developed in order to improve the uniformity of the film applied.

8347 (IAEA-TECDOC–604, pp. 159-174) **The Proto-ETA small-aspect-ratio experiment.** Ludwig, G.O. (Instituto Nacional de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). Lab. Associado de Plasma); Aso, Y.; Barroso, J.J. International Atomic Energy Agency, Vienna (Austria). May 1991. (CONF-9009463–: Technical committee on research using small tokamaks, Arlington, VA (United States), 27 Sep 1990). In *Research using small tokamaks: Proceedings of a technical committee meeting held in Arlington, Virginia, USA, 27-28 September 1990.* 198p. Order Number DE92615416. Source: OSTI; NTIS (US Sales Only); INIS.

Proto-ETA is a small-aspect-ratio tokamak (or "spherical torus") currently under design at the "Instituto Nacional de Pesquisas Espaciais" (National Institute for Space Research - INPE) in collaboration with Oak Ridge National Laboratory. The main objective of the device is to characterize the properties and the performance of low-aspect-ratio tokamak plasmas at relevant current and temperatures. This paper reports the current status of the conceptual design and discusses the models used to predict the operational regime and to design the main components of the device. (author). 15 refs, 12 figs, 2 tabs.

8348 (IAEA-TECDOC–604, pp. 189-193) **Design and fabrication of the HBT-EP tokamak: A large-aspect ratio, high beta, 10 msec pulsed tokamak.** Mauel, M.E. (Columbia Univ., New York, NY (United States). Plasma Physics Lab.); Gates, D.; Kombargi, R.; Navratil, G.A.; Vijaya Sankar, M.K. International Atomic Energy Agency, Vienna (Austria). May 1991. (CONF-9009463–: Technical committee on research using small tokamaks, Arlington, VA (United States), 27 Sep 1990). In *Research using small tokamaks: Proceedings of a technical committee meeting held in Arlington, Virginia, USA, 27-28 September 1990.* 198p. Order Number DE92615416. Source: OSTI; NTIS (US Sales Only); INIS.

An upgrade of the Columbia HBT tokamak is now under construction. Called HBT-EP (for extended pulse), it uses the toroidal field coil set from the former CLEO tokamak/stellarator at Culham which, together with the HBT power supplies, permits significantly extended performance over the HBT device. HBT-EP will have a major radius of R=0.92m, an aspect ratio between 6 and 7, a toroidal field capacity to 1 T, and an ohmic pulse length of $\geq$ 10 msec. Other key features of the device include (1) an adjustable internal conducting shell for external mode stability studies, (2) a variable plasma cross-section, and ultimately, (3) 2 MW of pulsed ICRF heating for pressure profile control and adjustment. Since HBT-EP is presently under construction, this report emphasizes our design procedure and calculations. Since HBT-EP is pulsed and designed to operate at high density, a rapid high-voltage start-up technique and a very low impurity environment are needed. A novel segmented vacuum chamber has been designed to be compatible with these requirements as well as the need for easy assembly. (author). 9 refs, 4 figs.

8349 (INIS-mf–13026, pp. 315-316) **Space charge effects in recirculation injection.** Jain, Arvind (Bhabha Atomic Research Centre, Bombay (India). Nuclear Physics Div.). Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990).* Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. 5 refs. BEAM INJECTION/space charge; MIGMA DEVICES/beam injection; BEAM BUNCHING; BEAM CURRENTS; DEUTERON BEAMS; MOLECULAR BEAMS; STRIPPING

8350 (INIS-mf–13062) **ITER plasma facing components.** ITER documentation series. Kuroda, T. (and others); Vieider, G.; Akiba, M. International Atomic Energy Agency, Vienna (Austria). Oct 1991 148p. Order Number DE92615478. Source: OSTI; NTIS (US Sales Only); INIS.

This document summarizes results of the Conceptual Design Activities (1988-1990) for the International Thermonuclear Experimental Reactor (ITER) project, namely those that pertain to the plasma facing components of the reactor vessel, of which the main components are the first wall and the divertor plates. After an introduction and an executive summary, the principal functions of the plasma-facing components are delineated, i.e., (i) define the low-impurity region within which the plasma is produced, (ii) absorb the electromagnetic radiation and charged-particle flux from the plasma, and (iii) protect the blanket/shield components from the plasma. A list of critical design issues for the divertor plates and the first wall is given, followed by discussions of the divertor plate design (including the issues of material selection, erosion lifetime, design concepts, thermal and mechanical analysis, operating limits and overall lifetime, tritium inventory, baking and conditioning, safety analysis, manufacture and testing, and advanced divertor concepts) and the first wall design (armor material and design, erosion lifetime, overall design concepts, thermal and mechanical analysis, lifetime and operating limits, tritium inventory, baking and conditioning, safety analysis, manufacture and testing, an alternative first wall design, and the limiters used instead of the divertor plates during start-up). Refs, figs and tabs.

8351 (INIS-mf–13063) **ITER fuel cycle.** ITER documentation series. Leger, D. (and others); Dinner, P.; Yoshida, H. International Atomic Energy Agency, Vienna (Austria). Nov 1991 221p. Order Number DE92615479. Source: OSTI; NTIS (US Sales Only); INIS.

Resulting from the Conceptual Design Activities (1988-1990) by the parties involved in the International Thermonuclear Experimental Reactor (ITER) project, this document summarizes the design requirements and the Conceptual Design Descriptions for each of the principal subsystems and design options of the ITER Fuel Cycle conceptual design. The ITER Fuel Cycle system provides for the handling of all tritiated water and gas mixtures on ITER. The system is subdivided into subsystems for fuelling, primary (torus) vacuum pumping, fuel processing, blanket tritium recovery, and common processes (including isotopic separation, fuel management and storage, and processes for detritiation of solid, liquid, and gaseous wastes). After an introduction describing system function and conceptual design procedure, a summary of the design is presented including a discussion of scope and main parameters, and the fuel design options for fuelling, plasma chamber vacuum pumping, fuel cleanup, blanket tritium recovery, and auxiliary and common processes. Design requirements are defined and design descriptions are given for the various subsystems (fuelling, plasma vacuum pumping, fuel cleanup, blanket tritium recovery, and auxiliary/common processes). The document ends with sections on fuel cycle design integration, fuel cycle building layout, safety considerations, a summary of the research and development programme, costing, and conclusions. Refs, figs and tabs.

8352 (INIS-mf–13085) **ITER newsletter. Vol. 4, no. 4.** International Atomic Energy Agency, Vienna (Austria). Sep 1991 16p. Order Number DE92615463. Source: OSTI; NTIS (US Sales Only); INIS.

Issue No. 4 of Volume 4 of the ITER Newsletter, prepared and published by the IAEA in order to disseminate news on the ITER project, reports on the following topics: (i) The fourth and final meeting of quadripartite EDA negotiators (QEN-4) on November 13 and 14, 1991 in Moscow, during which the ITER E(ngineering) D(esign) A(ctivities) Agreement was initialled, the expected ITER Council members were identified, and appreciation for the IAEA's support of the ITER project was expressed. (ii) The September meeting of the Quadripartite Engineering Design Activities Negotiators' (QEN) Working Group at the IAEA Headquarters in Vienna on September 11-13, 1991, in preparation of the aforementioned November meeting in Moscow, in which topics associated with future project implementation were addressed. (iii) The ITER Workshop on "Radiation Effects on Diagnostic Components", St. Petersburg, USSR, October 14-17, 1991, during which radiation issues affecting performance of diagnostic components were clarified, and during which it was confirmed that a large variety of irradiation facilities could be made available for testing of diagnostic materials. (iv) The "ITER Magnet R and D Workshop", September 23-27, 1991, at Naka Fusion Research Establishment, JAERI, Japan, during which preliminary designs and test programmes for C(entral) S(olenoid) and T(oroidal) F(ield) model coils were reported, and various approaches to the TF model coil's tests were presented and discussed. The plan for magnet R and D was reviewed. (v) The ITER Neutral Beam Heating, held in Moscow, October 21-23, 1991, during which the status of the neutral beam development was reviewed. The plan was formed to evolve common designs for the E(lectro) S(tatic) and E(lectro) S(tatic) Q(uadrupole) negative ion beams accelerator concepts. (vi) A two-page overview by V. Sulc of the research activity on the LiPb blanket for ITER in the nuclear research institute, REZ, CSFR.

8353 (JAERI-M–91-094) **Conceptual design of fusion experimental reactor (FER/ITER): Ion cyclotron wave system.** Kimura, Haruyuki (Japan Atomic Energy Research Inst., Naka, Ibaraki (Japan). Naka Fusion Research Establishment); Saigusa, Mikio; Saitoh, Yasushi. Japan Atomic Energy Research Inst., Tokyo (Japan). Jun 1991. 99p. Order Number DE92750949. Source: OSTI; NTIS (US Sales Only); INIS.

Conceptual design of the Ion Cyclotron Wave (ICW) system for FER and Japanese contribution to the conceptual design of the ITER ICW system are presented. A frequency range of the FER ICW system is 50-85 MHz, which covers $2\omega_{cT}$ heating, current drive by transit time magnetic pumping (TTMP) and $2\omega_{cD}$ heating. Physics analyses show that the FER and the ITER ICW systems are suitable for the central ion heating and the burn control. The launching systems of the FER ICW system and the ITER high frequency ICW system are characterized by in-port plug and ridged-waveguide-fed 5x4 phased loop array. Merits of those systems are (1) a ceramic support is not necessary inside the cryostat and (2) remote maintenance of the front end part of the launcher is relatively easy. Overall structure of the launching system is consistent with radiation shielding, cooling, pumping, tritium safety and remote maintenance. The launcher has injection capability of 20 MW in the frequency range of 50-85 MHz with the separatrix-antenna distance of 15 cm and steep scrape-off density profile of H-mode. The shape of the ridged waveguide is optimized to provide desired frequency range and power handling capability with a finite element method. Matching between the current strap and the ridged waveguide is satisfactorily good. Thermal analysis of the Faraday shield shows that high electric conductivity low Z material such as beryllium should be chosen for a protection tile of the Faraday shield. Thick Faraday shield is necessary to tolerate electromagnetic force during disruptions. R and D needs for the ITER/FER ICW systems are identified and gain from JT-60/60U ICRF experiments and operations are indicated in connection with them. (author).

8354 (JAERI-M–91-119) **Evaluation of tungsten temperature of divertor during Ex-LOCA and evaluation of corrosion depth of graphite during LOVA in fusion experimental reactor.** Ogawa, Masuro (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Tokai Research Establishment); Takatsu, Hideyuki; Iida, Hiromasa; Seki, Yasushi. Japan Atomic Energy Research Inst., Tokyo (Japan). Aug 1991. 33p. (In Japanese). Order Number DE92750953. Source: OSTI; NTIS (US Sales Only); INIS.

This paper deals with the evaluation of tungsten temperature of divertor during external loss of coolant accident (Ex-LOCA) in connection with the safety design of nuclear fusion experimental reactor. The present result and the results of U.S.A. and EC are discussed in the conceptual design of International Thermonuclear Engineering Reactor (ITER), and reference LOCA temperature is recommended to be 700±100degC for divertor, lasting 7 days. Corrosion depth of graphite tile of the first wall is evaluated during loss of vacuum accident (LOVA). The corrosion depth, duration time for the corrosion, generating heat, and volume of carbon monoxide are calculated when the carbon is attacked by oxygen in the air contained in the volume of the vacuum vessel. It is found that the results are not significant if fresh air does not continue to enter the vacuum vessel. (author).

8355 (JAERI-M–91-120) **Conceptual design of SC magnet system for ITER, (1): Overview.** Yoshida, Kiyoshi (Japan Atomic Energy Research Inst., Naka, Ibaraki (Japan). Naka Fusion Research Establishment); Hasegawa, Mitsuru; Okuno, Kiyoshi; Nishi, Masataka; Takahashi, Yoshikazu; Nakajima, Hideo; Tsuji, Hiroshi. Japan Atomic Energy Research Inst., Tokyo (Japan). Aug 1991. 125p. Order Number DE92750954. Source: OSTI; NTIS (US Sales Only); INIS.

The International Thermonuclear Experimental Reactor (ITER) is an experimental thermonuclear tokamak reactor that will test basic technologies of physics. The conceptual design activity of ITER required joint international work at the Max Plank Institute for Plasma Physics in the Garching Germany from 1988 to 1990. The proposals from Japan were summarized by the Fusion Experimental Reactor (FER) Team and the Superconducting Magnet Laboratory, both of the Japan Atomic Energy Research Institute (JAERI). This paper describes the Japanese contributions to the design concepts of the magnet system for ITER. The concepts of a magnet system design originated from the test data from the Large Coil Task and the Demo Poloidal Coil programs at JAERI. Most of design concepts are adapted for an option of the ITER Magnet design. The differences between Japanese design and the other designs will be analyzed using experimental results. (author).

8356 (JAERI-M–91-121) **Conceptual design of SC magnet system for ITER, (2): Stress analysis.** Koizumi, Koichi (Japan Atomic Energy Research Inst., Naka, Ibaraki (Japan). Naka Fusion Research Establishment); Hasegawa, Mitsuru; Yoshida, Kiyoshi. Japan Atomic Energy Research Inst., Tokyo (Japan). Aug 1991. 212p. Order Number DE92750955. Source: OSTI; NTIS (US Sales Only); INIS.

The International Thermonuclear Experimental Reactor (ITER) is an experimental tokamak machine testing the basic plasma performance and technologies required for future tokamak reactor. The design proposals for the Superconducting (SC) Magnet System from Japan were summarized by the Fusion Experimental Reactor (FER) Design Team and the Superconducting Magnet Laboratory of the Japan Atomic Energy Research Institute (JAERI). This report is one of the series reports on 'Conceptual design of superconducting magnet system for ITER', and describes the major results of the stress analysis regarding the Toroidal Field (TF) coil, the Center Solenoid (CS) coil and the Equilibrium Field (EF) coil and their support structures. Among the design issues, the mechanical design of the coil system was one of the most critical items, not only because of the huge electromagnetic loads due to large size and high magnetic field, but also because of the demand of high reliability under neutron irradiation. In order to satisfy both the coil performance and the mechanical reliability, different types of conductors were employed for each coils. The mechanical behaviors and the safety margin of each coil were analyzed by using finite element method (FEM) of MSC/NASTRAN. The procedure to obtain the equivalent winding stiffness employed for the each FEM analysis is also described in this report. The details on the coil specifications, conductor design and mechanical design for each coils are described in other report of the series reports. (J.P.N.).

8357 (JAERI-M-91-122) **Conceptual design of SC magnet system for ITER, (3): AC loss.** Hasegawa, Mitsuru (Japan Atomic Energy Research Inst., Naka, Ibaraki (Japan). Naka Fusion Research Establishment); Okuno, Kiyoshi; Takahashi, Yoshikazu; Nishio, Satoshi; Yoshida, Kiyoshi. Japan Atomic Energy Research Inst., Tokyo (Japan). Aug 1991. 83p. Order Number DE92750956. Source: OSTI; NTIS (US Sales Only); INIS.

The International Thermonuclear Experimental Reactor (ITER) is an experimental thermonuclear tokamak reactor testing the basic physics performance and technologies. The joint work of the conceptual design activity of ITER was carried out at the Max Planck Institute for Plasma Physics in Garching Germany from 1988 to 1990. The Japanese proposals for the superconducting (SC) coil system were summarized by the Fusion Experimental Reactor (FER) Team and the Superconducting Magnet Laboratory of the Japan Atomic Energy Research Institute (JAERI). This report is one of the series reports of 'conceptual design of SC magnet system for ITER', and treats the AC losses of the superconducting coil. The AC loss means the heat production in the winding packs and the supporting structure due to magnetic field change. Since the AC losses occupy about 50% of the total heat loads during the normal operation, the estimation of AC loss is important. On the other hand, the estimation of the AC loss during the disruption is also required to consider the stability of the superconducting coil. From these reasons, AC losses in the TF and PF coil winding packs and the supporting structures were computed for the normal operation and for the disruption. In addition the AC losses due to the separatrix sweep were also estimated. In these computations not only the time dependencies of the AC loss power, but also the spatial power distributions were obtained. (author).

8358 (JAERI-M-91-123) **Conceptual design of SC magnet system for ITER, (4): Power supply and cryogenic system.** Kato, Takashi (Japan Atomic Energy Research Inst., Naka, Ibaraki (Japan). Naka Fusion Research Establishment); Yoshida, Kiyoshi; Hiue, Hisaaki; Ookawa, Yoshinao. Japan Atomic Energy Research Inst., Tokyo (Japan). Aug 1991. 69p. Order Number DE92750957. Source: OSTI; NTIS (US Sales Only); INIS.

The International Thermonuclear Experimental Reactor (ITER) is an experimental thermonuclear tokamak reactor that will test some new technologies of physics. The conceptual design activity of ITER required the joint work at a technical site at the Max Plank Institute for Plasma Physics in the Garching Germany from 1988 to 1990. The proposals from Japan are summarized by the Fusion Experimental Reactor (FER) Team and the Superconducting Magnet Laboratory of the Japan Atomic Energy Research Institute (JAERI). This paper describes the Japanese contributions to the utility (power supply and cryogenic system) for the magnet system of ITER. The concepts of a magnet utility design were based on the construction experiences of the domestic test facilities of the Large Coil Task and of the JAERI's Demo Poloidal Coil program. During the conceptual design phase, it is important to know what parts are critical for construction and what subjects need development. In the power supply system, the DC beakers shall be modified to compact size. Several cryogenic components also require scale-up development during the engineering design phase. (author).

8359 (JAERI-M-91-125) **Conceptual design of SC magnet system for ITER, (6): R and D proposals.** Yoshida, Kiyoshi (Japan Atomic Energy Research Inst., Naka, Ibaraki (Japan). Naka Fusion Research Establishment); Sugimoto, Makoto; Tsuji, Hiroshi. Japan Atomic Energy Research Inst., Tokyo (Japan). Aug 1991. 72p. Order Number DE92750958. Source: OSTI; NTIS (US Sales Only); INIS.

The International Thermonuclear Experimental Reactor (ITER) is an experimental thermonuclear tokamak reactor in order to test the basic physics performance and technologies. The conceptual design activity (CDA) of ITER required the joint work at a technical site at the Max Plank Institute for Plasma Physics in the Garching, Germany from 1988 to 1990. The technical proposals from Japan were summarized by the Fusion Experimental Reactor (FER) Team and the Superconducting Magnet Laboratory of the Japan Atomic Energy Research Institute (JAERI). This paper describes the Japanese contributions of the R and D proposals to the magnet system for the ITER. These proposals were discussed in ITER CDA design team and summarized in ITER Technical report No. 20. The development program of Toroidal Field Coil is basically proposed from Japan with the design and analysis reports. The Japanese proposals are almost adopted in the ITER Long-Term R and D program. (author).

8360 (JAERI-M-91-126) **Conceptual design of Fusion Experimental Reactor: Safety analysis and evaluation.** Seki, Yasushi (Japan Atomic Energy Research Inst., Naka, Ibaraki (Japan). Naka Fusion Research Establishment); Takatsu, Hideyuki; Iida, Hiromasa. Japan Atomic Energy Research Inst., Tokyo (Japan). Aug 1991. 522p. (In Japanese). Order Number DE92751036. Source: OSTI; NTIS (US Sales Only); INIS.

Safety analysis and evaluation have been made for the FER (Fusion Experimental Reactor) as well as for the ITER (International Thermonuclear Experimental Reactor) which are basically same in terms of safety. This report describes the results obtained in FY 1988 - 1990, in addition to a summary of the results obtained prior to 1988. The report shows the philosophy of the safety design, safety analysis and evaluation for each of the operation conditions, namely, normal operation, repair and maintenance, and accident. Considerations for safety regulations and standards are also added. (author).

8361 (JAERI-M-91-133) **Japanese contributions to blanket design for ITER.** Kuroda, Toshimasa (Japan Atomic Energy Research Inst., Naka, Ibaraki (Japan). Naka Fusion Research Establishment); Yoshida, Hiroshi; Takatsu, Hideyuki. Japan Atomic Energy Research Inst., Tokyo (Japan). Aug 1991. 199p. Order Number DE92751041. Source: OSTI; NTIS (US Sales Only); INIS.

ITER, the first integrated fusion nuclear experimental reactor, will be equipped with tritium breeding blanket to produce tritium required for the ITER operation, in which annual tritium consumption will reach 6 kg. All participants (Japan, the EC, the USA and the USSR) in the ITER CDA (Conceptual Design Activity) have conducted conceptual design of ITER blanket (cooling water temperature $\leq$ 100degC) utilizing their own technology bases. Because of superiority of currently available data base and technology, solid breeder blanket has been selected as the first option among many proposals including the solid breeder blankets, the liquid metal blankets and the aqueous lithium salt blankets. This report describes the results of the following design and analytical studies on the Japanese proposal of Li_2O pebble type blanket : 1) blanket structural concepts, 2) neutronics, 3) thermal-hydraulics, 4) mechanical characteristics, 5) tritium recovery process and tritium inventory, and 7) fabrication and assembly technology. (author).

8362 (JAERI-M-91-168) **Evolution of magnetic moment due to the cyclotron resonance with field ripples in a tokamak.** Tanaka, Masatoshi (Japan Atomic Energy Research Inst., Naka, Ibaraki (Japan). Naka Fusion Research Establishment). Japan Atomic Energy Research Inst., Tokyo (Japan). Oct 1991. 31p. (In Japanese). Order Number DE92751058. Source: OSTI; NTIS (US Sales Only); INIS.

Toroidal field ripples of tokamaks resonate under certain conditions with the cyclotron motion of charged particles streaming along the magnetic field lines. This resonance may yield the evolution of the magnetic moment, a good adiabatic invariant of the motion in magnetic fields. The equation of motion for the magnetic moment is discretized to a mapping which describes the evolution of the magnetic moment across the successive resonances. On the basis of the mapping, derived the linear stability of the motion in the phase space and the diffusion constant of the magnetic moment when the motion becomes stochastic. (author).

8363 (JAERI-M-91-180) **Development of automatic control method for cryopump system for JT-60 neutral beam injector.** Shibanuma, Kiyoshi (Japan Atomic Energy Research Inst., Naka, Ibaraki (Japan). Naka Fusion Research Establishment); Akino, Noboru; Dairaku, Masayuki; Ohuchi, Yutaka; Shibata, Takemasa.

Japan Atomic Energy Research Inst., Tokyo (Japan). Oct 1991. 47p. (In Japanese). Order Number DE92751040. Source: OSTI; NTIS (US Sales Only); INIS.

A cryopump system for JT-60 neutral beam injector (NBI) is composed of 14 cryopumps with the largest total pumping speed of 20000 m^3/s in the world, which are cooled by liquid helium through a long-distance liquid helium transferline of about 500 m from a helium refrigerator with the largest capacity of 3000 W at 3.6 K in Japan. An automatic control method of the cryopump system has been developed and tested. Features of the automatic control method are as follows. 1) Suppression control of the thermal imbalance in cooling-down of the 14 cryopumps. 2) Stable cooling control of the cryopump due to liquid helium supply to six cryopanels by natural circulation in steady-state mode. 3) Stable liquid helium supply control for the cryopumps from the liquid helium dewar in all operation modes of the cryopumps, considering the helium quantities held in respective components of the closed helium loop. 4) Stable control of the helium refrigerator for the fluctuation in thermal load from the cryopumps and the change of operation mode of the cryopumps. In the automatic operation of the cryopump system by the newly developed control method, the cryopump system including the refrigerator was stably operated for all operation modes of the cryopumps, so that the cool-down of 14 cryopumps was completed in 16 hours from the start of cool-down of the system and the cryopumps was stably cooled by natural circulation cooling in steady-state mode. (author).

8364 (LBL–30529) **Development of a dc low pressure D^- surface-conversion source using a 10-cm-diameter solid barium converter.** Kwan, J.W.; Anderson, O.A.; Chan, C.F.; Cooper, W.S.; deVries, G.J.; Kunkel, W.B.; Leung, K.N.; Lietzke, A.F.; Steele, W.F.; van Os, C.F.A.; Wells, R.P.; Williams, M.D. Lawrence Berkeley Lab., CA (United States). Sep 1991. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-910943–4: 4. international conference on ion sources, Bensheim (Germany), 30 Sep - 4 oct 1991). Order Number DE92004686. Source: OSTI; NTIS; INIS; GPO Dep.

A D^- surface-conversion source using a solid barium converter is designed for steady-state operation to produce 200 mA of D^-. A similar ion source of twice the size as the one discussed here will meet the requirements set by the present US-ITER neutral beam injector design. Among the possible types of ion sources being considered for the US-ITER neutral beam design, the barium converter surface-conversion source is the only kind that does not use cesium in the discharge. This absence of cesium will minimize the number of accelerator breakdowns. 15 refs., 4 figs.

8365 (NIFS–101) **Conceptual design of D-^{3}He FRC reactor 'ARTEMIS'.** Momota, H. (and others); Ishida, A.; Kohzaki, Y. National Inst. for Fusion Science, Nagoya (Japan). Jul 1991. 45p. Order Number DE92750965. Source: OSTI; NTIS (US Sales Only); INIS.

A comprehensive design study of the D-^{3}He fueled field-reversed configuration (FRC) reactor 'ARTEMIS' is carried out for the purpose of proving its attractive characteristics and clarifying the critical issues for a commercial fusion reactor. The FRC burning plasma is stabilized and sustained in a steady equilibrium by means of a preferential trapping of D-^{3}He fusion-produced energetic protons. A novel direct energy converter for 15MeV protons is also presented. On the bases of a consistent scenario of the fusion plasma production and simple engineering, a compact and simple reactor concept is presented. The design of the D-^{3}He FRC power plant definitely offers the most attractive prospect for energy development. It is environmentally acceptable in view of radio-activity and fuel resources; and the estimated cost of electricity is low compared to a light water reactor. Critical issues concerning physics or engineering for the development of the D-^{3}He FRC reactor are clarified. (author).

8366 (NIFS-MEMO–2) **Development of three-dimensional compact magnetic dosimeter for environmental magnetic field monitoring.** Kubota, Yusuke; Obayashi, Haruo; Miyahara, Akira; Ohno, Kazuko; Nakamura, Kouichi; Horii, Kenzi. National Inst. for Fusion Science, Nagoya (Japan). Jul 1991. 48p. (In Japanese). Order Number DE92750825. Source: OSTI; NTIS (US Sales Only); INIS.

A computer-driven, three-dimensional magnetic fluxmeter to be used also for magnetic field dosimetry has been developed. A magnetic monitor applicable to this object should be measurable to an absolute value of local magnetic field strength and also be able to record its time integration as a measure of exposed dose to the magnetic field. The present fluxmeter consists of signal amplifiers, rectifiers, an A/D converter, and a pocket computer (PC). The signal outputs from the sensors are processed with the PC to compose an absolute strength of magnetic flux density and its time-integrated value. The whole system is driven by a battery and is quite compact in size to be used as a handy portable system. Further details of the design, idea, construction, specification, and testing result of the fluxmeter are described. The measurable range are from 0.4G to 20,000G in normal mode and 8mG to 400G in high-sensitivity AC mode, and the sensitivity is well independent of the magnetic field direction. These measured data are displayed in real time on the LCD panel of the PC and memorized in RAM files. Possible application of the fluxmeter are discussed with special attention to the search of the leakage and/or disturbing error fields around LHD (large Helical Device) and other magnetic systems, the individual dose control to the workers in strong magnetic fields, and the evaluation of the effects of long irradiation of magnetic fields. (author).

8367 **Plenum type crystal growth chamber.** Montgomery, K.E. To Dept. of Energy. 1990. Filed date 30 Oct 1989. USA Patent patent application 7-428,536. 8p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE92003831. Source: OSTI; NTIS; GPO Dep.

Crystals are grown in a tank which is divided by a baffle into a crystal growth region above the baffle and a plenum region below the baffle. A turbine blade or stirring wheel is positioned in a turbine tube which extends through the baffle to generate a flow of solution from the crystal growing region to the plenum region. The solution is pressurized as it flows into the plenum region. The pressurized solution flows back to the crystal growing region through return flow tubes extending through the baffle. Growing crystals are positioned near the ends of the return flow tubes to receive a direct flow of solution.

8368 (PNL-SA–19346) **The influence of helium on mechanical properties of model austenitic alloys determined using ^{59}Ni isotopic tailoring and fast reactor irradiation.** Hamilton, M.L.; Garner, F.A. Pacific Northwest Lab., Richland, WA (United States). Nov 1991. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC06-76RL01830. (CONF-911111–15: International conference on fusion reactor materials, Clearwater, FL (United States), 17-22 Nov 1991). Order Number DE92004505. Source: OSTI; NTIS; INIS; GPO Dep.

Tensile testing on model Fe-Cr-Ni alloys removed from four discharges of the ^{59}Ni isotopic doping experiment in FFTF indicates that helium/dpa ratios typical of fusion reactors do not produce changes in the yield strength or elongation that are significantly different from those at much lower helium generation rates. It also appears that tensile properties approach a saturation level that is dependent only on the final irradiation temperature, but not prior temperature history or thermomechanical starting condition. 14 refs., 4 figs., 1 tab.

8369 (PNL-SA–19386) **Irradiation performance of oxide dispersion strengthened copper alloys to 150 dpa at 415°C.** Edwards, D.J. (Missouri Univ., Rolla, MO (United States)); Kumar, A.S.; Anderson, K.R.; Stubbins, J.F.; Garner, F.A.; Hamilton, M.L. Pacific Northwest Lab., Richland, WA (United States). Nov 1991. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract AC06-76RL01830 ;FG06-89ER75522. (CONF-911111–17: International conference on fusion reactor materials, Clearwater, FL (United States), 17-22 Nov 1991). Order Number DE92004511. Source: OSTI; NTIS; INIS; GPO Dep.

Results have been obtained on the post-irradiation properties of various oxide dispersion strengthened copper alloys irradiated from 34 to 150 dpa at 415°C in the Fast Flux Test Facility. The GlidCop alloys strengthened by Al_2O_3 continue to outperform other alloys with respect to swelling resistance, and retention of both electrical conductivity and yield strength. Several castable ODS alloys and a

Cr_2O_3-strengthened alloy show increasingly poor resistance to radiation, especially in their swelling behavior. A HfO_2-strengthened alloy retains most of its strength and its electrical conductivity reaches a constant level after 50 dpa, but it exhibits a higher residual radioactivity.

8370 (PNL-SA-19387) **Response of solute and precipitation-strengthened copper alloys at high neutron exposure.** Garner, F.A. (Pacific Northwest Lab., Richland, WA (United States)); Hamilton, M.L.; Shikama, T.; Edwards, D.J.; Newkirk, J.W. Pacific Northwest Lab., Richland, WA (United States). Nov 1991. 23p. Sponsored by U.S. DOE Energy Research. DOE Contract AC06-76RL01830. (CONF-911111-14: International conference on fusion reactor materials, Clearwater, FL (United States), 17-22 Nov 1991). Order Number DE92004504. Source: OSTI; NTIS; INIS; GPO Dep.

A variety of solute and precipitation strengthened copper base alloys have been irradiated to neutron-induced displacement levels of 34 to 150 dpa at 415°C and 32 dpa at 529°C in the Fast Flux Test Facility to assess their potential for high heat flux applications in fusion reactors. Several MZC-type alloys appear to offer the most promise for further study. For low fluence applications CuBeNi and spinodally strengthened CuNiTi alloys may also be suitable. Although Cu-2Be resists swelling, it is not recommended for fusion reactor applications because of its low conductivity.

8371 (PNL-SA-19571) **Production bias: A proposed modification of the driving force for void swelling under cascade damage conditions.** Woo, C.H. (Atomic Energy of Canada Ltd., Pinawa, MB (Canada). Whiteshell Labs.); Singh, B.N.; Garner, F.A. Pacific Northwest Lab., Richland, WA (United States). Nov 1991. 19p. Sponsored by U.S. DOE Energy Research. DOE Contract AC06-76RL01830. (CONF-911111-16: International conference on fusion reactor materials, Clearwater, FL (United States), 17-22 Nov 1991). Order Number DE92004512. Source: OSTI; NTIS; INIS; GPO Dep.

A new concept of point-defect production as the main driving force for void swelling under cascade damage conditions is proposed. This concept takes into account the recombination and formation of immobile clusters and loops of vacancies and interstitials in the cascade region. The life times of the clusters and loops due to desolution are strong functions of the temperature, as well as their vacancy and interstitial nature. The resulting biased production of free point defects from the internal sources is shown to be a strong driving force for void swelling. The characteristics of void swelling due to production bias are described and compared with experimental results. We conclude that the production bias concept provides a good description of void swelling under cascade damage conditions.

8372 (PPPL-2788) **Facilities for technology testing of ITER divertor concepts, models, and prototypes in a plasma environment.** Cohen, S.A. Princeton Univ., NJ (United States). Plasma Physics Lab. Dec 1991. 111p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03073. Order Number DE92005129. Source: OSTI; NTIS; INIS; GPO Dep.

The exhaust of power and fusion-reaction products from ITER plasma are critical physics and technology issues from performance, safety, and reliability perspectives. Because of inadequate pulse length, fluence, flux, scrape-off layer plasma temperature and density, and other parameters, the present generation of tokamaks, linear plasma devices, or energetic beam facilities are unable to perform adequate technology testing of divertor components, though they are essential contributors to many physics issues such as edge-plasma transport and disruption effects and control. This Technical Requirements Documents presents a description of the capabilities and parameters divertor test facilities should have to perform accelerated life testing on predominantly technological divertor issues such as basic divertor concepts, heat load limits, thermal fatigue, tritium inventory and erosion/redeposition. The cost effectiveness of such divertor technology testing is also discussed.

8373 (SAND-91-1163C) **Deposition of deuterium and metals on divertor tiles in the DIII-D tokamak.** Walsh, D.S. (Idaho State Univ., Pocatello, ID (United States)); Doyle, B.L.; Jackson, G.L. Sandia National Labs., Albuquerque, NM (United States). [1991]. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract AC04-76DP00789. (CONF-911132-7: 38. national symposium of the American Vacuum Society, Seattle, WA (United States), 11-15 Nov 1991). Order Number DE92003648. Source: OSTI; NTIS; INIS; GPO Dep.

Hydrogen recycling and impurity influx are important issues in obtaining high confinement discharges in the D3-D tokamak. To reduce metallic impurities in D3-D, 40% of the wall area, including the highest heat flux zones, have been covered with graphite tiles. However erosion, redeposition and hydrogen retention in the tiles, as well as metal transport from the remaining Inconel walls can lead to enhanced recycling and impurity influx. Hydrogen and metal retention in divertor floor tiles have been measured using external ion beam analysis techniques following four campaigns where tiles were exposed to several thousand tokamak discharges. The areal density of deuterium retained following exposure to tokamak plasmas was measured with external nuclear reaction analysis. External proton-induced x-ray emission analysis was used to measure the areal densities of metallic impurities deposited upon the divertor tiles either by sputtering of metallic components during discharges or as contamination during tile fabrication. Measurements for both deuterium and metallic impurities were taken on both the tile surfaces which face the operating plasma and the surfaces on the side of the tiles which form the small gaps separating each of the tiles in the divertor. The highest areal densities of both deuterium and metals were found on the plasma-facing surface near the inner strike point region of each set of divertor tiles. Significant deposits, extending as fast a 1 cm from the plasma-facing and containing up to forty percent of the total divertor deposition, were also observed on the gap-forming surfaces of the tiles.

8374 (SAND-91-1700C) **Determination of deuterium gas pressure in plastic targets by Nuclear Magnetic Resonance.** Schneider, D.A.; Aubert, J.H.; Assink, R.A. Sandia National Labs., Albuquerque, NM (United States). [1991]. 8p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-9109319-2: 8. target fabrication specialists' meeting, Albuquerque, NM (United States), 23-26 Sep 1991). Order Number DE92004212. Source: OSTI; NTIS (US Sales Only); GPO Dep.

A recent target series on PBFAII included gas-filled spherical plastic shells. The 6mm diameter shells were prepared at LANL and had a multilayer structure consisting of 25 μm parylene-D, 5 μm poly(vinyl alcohol) (PVA), and 70 μm of parylene-N. The inner layer of parylene-D provided chlorine to allow diagnosis of the hydrodynamics of the imploding shell. The PVA layer provided a gas permeation barrier, and the thick outer layer of parylene-N provided sufficient stopping power for the PBFAII proton beam. The gas fill was originally 1100 torr of deuterium and 7.7 torr of hydrogen sulfide and was through a stainless steel/parylene stem with on one-use valve. Subsequent fills were made via permeation. In order to shoot the targets on PBFAII it was necessary to know the gas fill at shot time. The typical holding time in the PBFAII diode was two days. During this time the completed target would lose gas pressure via permeation. Therefore, to know the gas pressure at shot time required both knowledge of the pressure at target loading and good characterization of the permeation rate. Nuclear Magnetic Resonance (NMR) Spectroscopy was chosen to characterize the permeation of deuterium through the plastic shells.

8375 (UCLA-PPG-1380) **Plasma-materials interactions and edge-plasma physics research: Progress report, 1990-1991: PISCES Program.** Hirooka, Y. (ed.). California Univ., Los Angeles, CA (United States). Inst. of Plasma and Fusion Research. Dec 1991. 62p. Sponsored by U.S. DOE Energy Research. DOE Contract FG03-86ER52134. Order Number DE92006426. Source: OSTI; NTIS; INIS; GPO Dep.

This report discusses the: Pisces Program; Pisces Facilities; Pisces Experiments: Materials and Surface Physics; Pisces Experiments: Edge Plasma Physics; and, Theoretical Analysis: Edge Plasma Behavior.

8376 (UCRL-JC-106873) **EDS analysis of bromine in polymers.** Price, C.W.; Lindsey, E.F.; Letts, S.A. Lawrence Livermore National Lab., CA (United States). 14 Mar 1991. 4p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-910870-25: 49. Electron Microscopy Society of America

(EMSA) annual meeting, San Jose, CA (United States), 4-9 Aug 1991). Order Number DE92004160. Source: OSTI; NTIS; INIS; GPO Dep.

Design requirements for the Inertial Confinement Fusion program at LLNL frequently require polymers to be modified with known amounts of dopants without seriously degrading the surface finish. Techniques such as x-ray fluorescence permit reliable quantitative analyses of the dopants. However, our strong emphasis on surface finish requires frequent SEM examinations, and the need for rapid analyses instigated on evaluation of EDS to analyze bromine in the SEM. Brominated polymers based on polystyrene and a plasma-deposited hydrocarbon with a composition of approximately $CH_{1.2}$ were analyzed. The analyses were performed using an optional thin window in a NORAN Micro-Z 2 Si(Li) EDS mounted on a Hitachi S-800 FESEM. The specimens were coated with palladium. Since the standard ZAF programs are ineffective for hydrocarbon-based materials, calibration curves were established using Br L_α/C K_α peak ratios. A cryogenic vacuum system on the FESEM significantly reduced detrimental effects of carbon contamination on the sensitivity of the C K_α peak. Brominated polymers are susceptible to electron-beam damage, so the extent of damage and its effect on the EDS analysis also had to be determined. 3 figs.

99 GENERAL AND MISCELLANEOUS

Refer also to citation(s) 6774, 8449

8377 (ANL/CP-73778) **Universities and national laboratory roles in nuclear engineering.** Sackett, J.I. Argonne National Lab., Idaho Falls, ID (United States). [1991]. 4p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. (CONF-911107-35: Winter meeting of the American Nuclear Society (ANS), San Francisco, CA (United States), 10-15 Nov 1991). Order Number DE92001912. Source: OSTI; NTIS; INIS; GPO Dep.

Nuclear Engineering Education is being significantly challenged in the United States. The decline in enrollment generally and the reduction of the number of nuclear engineering departments has been well documented. These declines parallel a lack of new construction for nuclear power plants and a decline in research and development to support new plant design. Precisely at a time when innovation is is needed to deal with many issues facing nuclear power, the number of qualified people to do so is being reduced. It is important that the University and National Laboratory Communities cooperate to address these issues. The Universities must increasingly identify challenges facing nuclear power that demand innovative solutions and pursue them. To be drawn into the technology the best students must see a future, a need and identify challenges that they can meet. The University community can provide that vision with help from the National Laboratories. It has been a major goal within the reactor development program at Argonne National Laboratory to establish the kind of program that can help accomplish this.

8378 (BNL-46576) **A woman like you: Women scientists and engineers at Brookhaven National Laboratory: Careers in action.** Brookhaven National Lab., Upton, NY (United States). [1991]. 22p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract AC02-76CH00016. Order Number DE92004996. Source: OSTI; NTIS; GPO Dep.

This publication by the women in Science and Engineering introduces career possibilities in science and engineering. It introduces what work and home life are like for women who have already entered these fields. Women at Brookhaven National Laboratory work in a variety of challenging research roles – from biologist and environmental scientist to safety engineer, from patent lawyer to technician. Brookhaven National Laboratory is a multi-program laboratory which carries out basic and applied research in the physical, biomedical and environmental sciences and in selected energy technologies. The Laboratory is managed by Associated University, Inc., under contract with the US Department of Energy. Brookhaven and the other national laboratories, because of their enormous research resources, can play a critical role in a education and training of the workforce.

8379 (DOE/ER-0249(91)) **Application and guide for the Special Research Grant Program 10 CFT Part 605.** USDOE Office of Energy Research, Washington, DC (United States). [1991]. 57p. Sponsored by U.S. DOE Energy Research. Source: OSTI (Free of Charge).

The Office of Energy Research (ER) established a Special Research Grant Program coded in 10 CFR Part 605 in April 1985. This regulation, in coordination with the US Department of Energy's (DOE) generic grant regulations, codified in 10 CFR Part 600, provides the administrative requirements to be used when supporting research, training and related activities in the scientific areas of interest to ER. This guide was developed to assist potential applicants and recipients of ER grants in understanding the required forms, formats, pre- and post-award administration requirements, and the award process utilized within ER program and DOE awarding offices for ER Special Research Grants. Individually published notices of availability or solicitations may change or amend information contained in this guide. Even though the purpose of this booklet is to inform eligible applicants of the special and generic financial assistance policies and procedures, it may be necessary to refer to both Parts 600 and 605 to obtain a comprehensive understanding of the full requirements for financial assistance support within ER.

8380 (LA-UR-91-3693) **Science, technology, environment, and competitiveness in a North American context.** Trocki, L.K. Los Alamos National Lab., NM (United States). [1991]. 14p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract W-7405-ENG-36. (CONF-9111147-1: Harmonizing economic competitiveness with environmental quality: a North American Challenge, Santa Fe, NM (United States), 8-9 Nov 1991). Order Number DE92003783. Source: OSTI; NTIS; INIS; GPO Dep.

Most economic activities pollute. Environmental regulations should serve the public good by providing incentives to reduce pollution caused by economic activity. Economic incentives include pollution taxes, subsidies for pollution abatement, and tradeable permits or allowances to pollute. Because of the political unacceptability of taxes and permits, much regulation imposes command and control measures and provides less incentive to minimize pollution. Efficient incentives would encourage pollution abatement up to the point where the cost of abatement equals the social and private benefit from the improvements in the environment. While these costs and benefits are difficult to measure, many analysts contend that the way environmental laws have been formulated and implemented in the US leads to very inefficient pollution control. This inefficiency can contribute to a decline in economic competitiveness in the long run, although economic studies do not support the "pollution haven" hypothesis. Better analysis (foresight) of the cost of transboundary pollution, significant in the Great Lakes region and along the US- Mexico border, as well as in rivers that flow between countries, is needed to formulate more effective policies and avoid sorry hindsight. Also, application of communal experience, technologies, and methods applied to shared problems can avoid costly duplication of searches for the optimal pollution abatement measures. 14 refs.

8381 (PNL-7713-HEDR) **Document search and declassification for Phase 1 of the HEDR Project.** Pacific Northwest Lab., Richland, WA (United States). May 1991. 8p. Sponsored by U.S. DOE Environment Safety & Health. DOE Contract AC06-76RL01830. Order Number DE92004564. Source: OSTI; NTIS; GPO Dep.

This letter report describes how Hanford Environmental Dose Reconstruction (HEDR) Project staff identified, searched for, evaluated, described, declassified, and made documents available during Phase 1 of the project. The objective of these activities was to find and make available HEDR-related information that was generated at the Hanford Site. Users of the information were HEDR staff, the Technical Steering Panel (TSP), and the public.

9901 Management

Refer also to citation(s) 6448, 6712, 6779, 6784, 6790, 6803, 6854, 6867, 7237, 7518, 7616

8382 (BNL-46856) **An organizational survey of the Los Alamos Site.** Shurberg, D.A.; Haber, S.B. Brookhaven National Lab., Upton, NY (United States). Nov 1991. 110p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-9108150-3: 9. international conference on positron annihilation, Szombathely (Hungary), 26-31 Aug 1991). Order Number DE92005024. Source: OSTI; NTIS; GPO Dep.

An Organizational Survey (OS) was administered at the Los Alamos Site that queried employees on the subjects of organizational culture, various aspects of communications, employee commitment, work group cohesion, coordination of work, environmental, safety, and health concern, hazardous nature of work, safety and overall job satisfaction. The purpose of the OS is to measure in a quantitative and objective way the notion of "culture;" that is, the values, attitudes, and beliefs of the individuals working within the organization. In addition, through the OS, a broad sample of individuals can be reached that would probably not be interviewed or observed during the course of a typical assessment. The OS also provides a descriptive profile of the organization at one point in time that can then be compared to a profile taken at a different point in time to assess changes in the culture of the organization. While comparisons among groups are made, it is not the purpose of this report to make evaluative statements of which profile may be positive or negative. However, using the data presented in this report in conjunction with other evaluative activities, may provide useful insight into the organization. The OS administration at the Los Alamos Site was the ninth to occur at a Department of Energy (DOE) facility. All data from the OS is presented in group summaries, by organization, department or directorate within organization, supervisory level both overall and within organization, and staff classification within organization. Statistically significant differences between groups are identified and discussed. 9 refs., 94 figs., 11 tabs.

8383 (CONF-9111126-3) **The application of computer-based testing to allow testing out in retraining subjects.** Portwood, G.; Johnson, K.; Webster, C. Oak Ridge National Lab., TN (United States). [1991]. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 15. annual TRADE (training resources and data exchange) conference; St. Petersburg, FL (United States); 18-20 Nov 1991. Order Number DE92003561. Source: OSTI; NTIS; GPO Dep.

ORNL's computer-generated test our program, developed using computer-based training (CBT) technology, allows employees the option of "testing out" instead of attending the General Employee Retraining (GER) class. The program contains a "bank" of questions; 20 different questions randomly selected by the computer for each exam. The exam is administered by computer; minimum input is required of the individual taking the exam. The training organization inputs the bank of exam questions, the type of questions to be used, and categorizes questions according to subject, such as Quality Assurance, Hazard Communication, Radiation Safety, and so forth. The exam is graded by the computer and a hard-copy record may be generated. Exam results may be stored on a floppy disk. Compliance training, as required by the US Department of Energy (DOE) in many areas, has become an activity which requires individuals to spend more and more of their time in training. Compliance training could be defined as, "training that is required for individuals who perform certain activities." In other words, it is training that is not optional. Compliance training exists for subjects that are general in nature such as General Employee Training (GET), and for subjects of a more technical nature such as Rad Worker, SARA/OSHA, and so forth. The computer-generated program, developed by ORNL using computer-based training technology, meets the criteria for compliance training, but "training time" or "man training hours" in the pilot program was reduced from two hours per person to about 20 minutes per person. Overall training time for the pilot program was reduced by almost sixty percent.

8384 (DOE/EH-0206) **Organizational Cultural Assessment of the Idaho National Engineering Laboratory.** USDOE, Washington, DC (United States). Jun 1991. 198p. Sponsored by U.S. DOE Environment Safety & Health. Order Number DE92003032. Source: OSTI; NTIS; GPO Dep.

An Organizational Cultural Assessment (OCA) was performed at the Idaho National Engineering Laboratory (INEL) by administering an Organizational Culture Survey (OCS) that queried employees on the subjects of organizational culture, various aspects of communications, employee commitment, work group cohesion, coordination of work, environmental concerns, hazardous nature of work, safety and overall job satisfaction. Many of these subjects are assessed in the OCS through highly developed and validated scales that have been administered in many different types of organizations. The purpose of the OCS is to measure in a quantitative and objective way the notion of "culture;" that is, the values, attitudes, and beliefs of the individuals working within the organization. In addition, through the OCS, a broad sample of individuals can be reached that would probably not be interviewed or observed during the course of a typical assessment. The OCS also provides a descriptive profile of the organization at one point in time that can then be compared to a profile taken at a different point in time to assess changes in the culture of the organization. The OCS administration at the INEL was the sixth to occur at a Department of Energy (DOE) facility. The INEL Organization is somewhat different from other DOE facilities are which the OCS was administered, due to the presence of six different major operating contractors. The seven organizations assessed at the INEL are: (1) Argonne National Laboratory – West; (2) DOE Fire Department/Radiological and Environmental Sciences Laboratory; (3) EG&G Idaho Incorporated; (4) MK Ferguson; (5) Protection Technology Incorporated; (6) Rockwell; and (7) Westinghouse Idaho Nuclear Company Incorporated. All data from the OCS is presented in group summaries by organization, Supervisory Level, Staff Classification, and department within organization. Statistically significant differences between groups are identified and discussed.

8385 (DOE/NV/10845-12) **Information management plan for the Nevada Test Site Groundwater Characterization Project.** Thompson, C.B.; Russell, C.E. Nevada Univ., Las Vegas, NV (United States). Water Resources Center. Dec 1991. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC08-90NV10845. Order Number DE92004123. Source: OSTI; NTIS; GPO Dep. Publication No. 45092.

Information management plays a significant role in the Groundwater Characterization Project (GCP) because of its size and complexity. Information management shares complementary roles with research objectives and quality assurance (QA) to define how the project will be implemented. Information management serves as a backbone to the research effort by tying various project components together, from data collection through data analysis to the use of the information by researchers and program managers. The information collected and analyzed from the Groundwater Characterization Project must be available to its users in a timely, cost-effective, and accurate manner. The quality and validity of these data are important to the overall Nevada Test Site program. The activities in this plan include: field activities; sample collection; processing, and tracking; data base design and management; retrieval, analysis, and dissemination of the data; and, archiving and cataloging of the data and documentation. The implementation of information management with respect to these activities is defined in this plan as strategies supplemented by Standard Operating Procedures (SOPs) to provide the details of each activity. The Quality Assurance Plan (QAP) seeks to assure that the information collected is of the highest possible quality permitted under current technology and science and is error-free.

8386 (IAEA-TSRA-1) **Transport safety research abstracts. No. 1: Information on research recently concluded and in progress.** International Atomic Energy Agency, Vienna (Austria). Jul 1991. 91p. Order Number DE92614117. Source: OSTI; NTIS (US Sales Only); INIS.

The Transport Safety Research Abstracts is a collection of reports from Member States of the International Atomic Energy Agency, and other international organizations on research in progress or just completed in the area of safe transport of radioactive material. The main aim of TSRA is to draw attention to work that is about to be published, thus enabling interested parties to obtain further information through direct correspondence with the investigators. Information contained in this issue covers work being undertaken in 6 Member States and contracted by 1 international organization; it is hoped with succeeding issues that TSRA will be able to widen this base. TSRA is modelled after other IAEA publications describing work in progress in other programme areas, namely Health Physics Research Abstracts (No. 14 was published in 1989), Waste Management Research Abstracts (No. 20 was published in 1990), and Nuclear Safety Research Abstracts (No. 2 was published in 1990).

8387 (IPEN-PUB–337) **Quality manual for Laboratories of the Nuclear Materials Characterization Division.** Sabato, S.F. Instituto de Pesquisas Energeticas e Nucleares (IPEN), Sao Paulo, SP (Brazil). May 1991. 63p. (In Portuguese). Order Number DE92614118. Source: OSTI; NTIS (US Sales Only); INIS.

This publication presents the first Quality Manual for the Laboratories at the Nuclear Materials Characterization Division. The Manual describes the laboratories, its organization structure, fields of activities, personnel records, equipments, maintenance and calibration. The main aspects concerning quality assurance in the analysis were discussed. The whole system of receiving, identifying and processing analysis of the samples is shown. Since there are many information to be contained in several subjects of the Quality Manual, there were produced separate documents that are cross referenced in the manual. (author).

8388 (KAERI/RR–957/90) **Quality assurance for the research and development of nuclear technology.** Yang, Myung Seung (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Kim, Young Sea; Lim, Nam Jin. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Jan 1991. 235p. (In Korean). Order Number DE92615201. Source: OSTI; NTIS (US Sales Only); INIS.

KAERI is carrying out several large nuclear R and D projects to achieve the indigenization of nuclear technology in Korea. In order to accomplish nuclear projects effectively, the KAERI-wide quality assurance system as well as project quality systems has been prepared for the coordination and effective implementation of various quality activities. The revision of KAERI QA Program Plan will help to establish and upgrade the effective and efficient KAERI-wide QA system. Technical support activities to the project QA program were performed in more systematic way. KAERI QA Committee was organized, and the meeting was held periodically to discuss and find out the optimum solution for the critical quality problems. Quality evaluation including internal audits was carried out to analyze the QA activities in the various projects and evlauation results was condensed to quality trend analysis. QA record preserving facility was built and was being used to maintain the QA records. The basic studies on the computer S/W QA, QA in R and D, quality costs analysis were also performed to upgrade the safety and reliability. (Author).

8389 (KURRI-TR–353) **Summary reports of activities under visiting research program, second half of 1990.** Kyoto Univ , Kumatori, Osaka (Japan). Research Reactor Inst. Jul 1991. 101p. (In Japanese). Order Number DE92751062. Source: OSTI; NTIS (US Sales Only); INIS.

The Technical Report of the Research Reactor Institute, Kyoto University, is published as occasion demands, summarizing as prompt reports the date required for research and experiment, such as the results of the functional test on various experimental facilities, the results of the test on the things manufactured for trial, the state of radiation control and waste treatment, the reports of study meetings and so on, or the remarkable results and new methods obtained on the way of research, and the discussion on other papers and reports. In this report, 78 visiting research projects using the KUR and 10 visiting research projects using the KUCA in the second half of 1990 are summarized. Also 2 projects in the first half of 1990 are added. The adoption No., the kind of project, title, the names of researchers and their posts, and the gist of research are reported in each project. (K.I.).

8390 (NEI-SE–68) **The electric power system in the year 2050.** Gerholm, T.R. Swedish State Power Board, Vaellingby (Sweden). Mar 1991. 40p. (In Swedish). Order Number DE92614119. Source: OSTI; NTIS (US Sales Only); INIS.

The need of electric energy in Sweden the year 2050 as well as the generation and transmission of electric power are discussed in this report. (K.A.E.).

8391 (WHC-SA–1403) **A trainer's role in effecting a cultural change.** Hopkins, G.P. Westinghouse Hanford Co., Richland, WA (United States). Nov 1991. 10p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract AC06-87RL10930. (CONF-9111126–1: 15. annual TRADE (training resources and data exchange) conference, St. Petersburg, FL (United States), 18-20 Nov 1991). Order Number DE92003632. Source: OSTI; NTIS; GPO Dep.

Teaching is a process used to bring about a change in a person or target group for the benefit of that individual, society, or the organization. The trainer's role in effecting a cultural change is not as a teacher of cultural behaviors but as a facilitator of cultural change. This paper will concentrate primarily on the analysis, solicitation of management support, and implementation phases of effecting a cultural change among a target group from the trainer's side of the process. The three major aspects of a cultural change program also will be discussed. They are: (1) gathering data, (2) soliciting management support, and (3) the implementation phase. Analysis tools such as direct observation measurement, informal and formal surveys will be discussed, and the uses of each will be demonstrated. The data gathered in the analysis phase will be used to identify cultural deficiencies in the group and to solicit management support for a cultural change. The design and development phases will be bypassed, and several methods of accomplishing the implementation phase will be highlighted.

9902 Mathematics and Computers

Refer also to citation(s) 6247, 6254, 6287, 6300, 6333, 6409, 6410, 6423, 6427, 6433, 6435, 6443, 6473, 6479, 6501, 6531, 6630, 6635, 6654, 6655, 6659, 6706, 6714, 6715, 6716, 6725, 6726, 6745, 6747, 6749, 6847, 6864, 6945, 6952, 6954, 6955, 7144, 7145, 7154, 7175, 7180, 7185, 7186, 7187, 7201, 7203, 7206, 7219, 7221, 7222, 7223, 7229, 7262, 7264, 7287, 7292, 7367, 7370, 7413, 7467, 7497, 7518, 7521, 7549, 7576, 7590, 7596, 7616, 7633, 7634, 7636, 7644, 7669, 7686, 7813, 7814, 7815, 7816, 7817, 7820, 7823, 7824, 7825, 7864, 7869, 7895, 7903, 7965, 8129, 8133, 8157, 8158, 8172, 8255, 8257, 8308, 8329, 8334, 8337, 8439, 8442, 8445

8392 (ANL/CP–74794) **Rationale for guaranteed ODE defect control.** Corless, R.M. (University of Western Ontario, London, ON (Canada). Dept. of Applied Mathematics); Corliss, G.F. Argonne National Lab., IL (United States). [1991]. 11p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract W-31109-ENG-38. Grant CCR-8802429. (CONF-9110300–2: SCAN '91: international symposium on computer arithmetic and scientific computing, Oldenburg (Germany), 1-4 Oct 1991). Order Number DE92004721. Source: OSTI; NTIS; GPO Dep.

We introduce a modification of existing algorithms that allows easier analysis of numerical solutions of ordinary differential equations. We relax the requirement that the specified problem solved, and instead solve a "nearby" problem exactly, in Wilkinson's tradition of backward error analysis. The precise meaning of "nearby" is left to the user. This inexpensive algorithm sublimates the well-known difficulties associated with the propagation of accumulated error and avoids the difficulty of exponential growth of inclusion widths associated with internal techniques. No claim is made for the accuracy with which the specified problem is solved. It is shown that often no such claim is necessary. 14 refs., 4 figs.

8393 (ANL/CP–74795) **On implicit Taylor series methods for stiff ODEs.** Kirlinger, G. (Technische Univ., Vienna (Austria). Inst. fuer Angewandte und Numerische Mathematik); Corliss, G.F. Argonne National Lab., IL (United States). [1991]. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-9110300–1: SCAN '91: international symposium on computer arithmetic and scientific computing, Oldenburg (Germany), 1-4 Oct 1991). Order Number DE92004720. Source: OSTI; NTIS; GPO Dep.

Several versions of implicit Taylor series methods (ITSM) are presented and evaluated. Criteria for the approximate solution of ODEs via ITSM are given. Some ideas, motivations, and remarks on the inclusion of the solution of stiff ODEs are outlined. 25 refs., 3 figs.

8394 (ANL/TM–489) **A plan for administrative computing at ANL: FY1992–FY1994.** Caruthers, M.S. (ed.); O'Brien, D.E.; Bretscher, M.E.; Hischier, R.C.; Moore, N.J.; Slade, R.G. Argonne National Lab., IL (United States). Nov 1991. 146p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. Order Number DE92005358. Source: OSTI; NTIS; GPO Dep.

This report discusses the data processing future of ANL. Chapter 1, "Introduction," assesses the state of administrative computing at ANL and the implications of FY1992 funding recommendations. It includes a history of Management Information System (MIS) planning for administrative data processing. Chapter 2, "Administrative Computing Goals and Strategy," discusses the strategy and goals which are an important part of administrative data processing plans for the Laboratory. Chapter 3, "Management Guidelines for Administrative Computing," describes the management guidelines established by ADPO for the proposal and implementation of administrative computing systems. The guidelines are a valuable tool for management in determining what applications would be appropriate to their needs and in formulating the proposals for those applications. Chapter 4, "Proposed Projects," summarizes the proposals for new or enhanced administrative computing systems presented to ADPO by individual divisions or departments with the assistance of Management Information Systems. The summaries indicate some of the possibilities for the development of administrative computing systems at ANL. The areas of the various proposals are diverse, but they share a common concern with the integration and unification of existing systems into a more efficient and productive whole. Chapter 5, "Implementation of Proposed Plan," describes training and personnel resources used in developing and implementing proposed systems. Synopses of the administrative computing systems developed and maintained by the divisions and departments of Argonne National Laboratory appear in Appendix F, "Systems Synopses".

8395 (DOE/ER/25018–4) **Numerical solution of nonlinear algebraic equations in stiff ODE solving (1986–89)—Quasi-Newton updating for large scale nonlinear systems (1989–90): Final report, 1986–1990.** Walker, H.F. Utah State Univ., Logan, UT (United States). Dept. of Mathematics and Statistics. [1990]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER25018. Order Number DE92004839. Source: OSTI; NTIS; GPO Dep.

During the 1986–1989 project period, two major areas of research developed into which most of the work fell: "matrix-free" methods for solving linear systems, by which we mean iterative methods that require only the action of the coefficient matrix on vectors and not the coefficient matrix itself, and Newton-like methods for underdetermined nonlinear systems. In the 1990 project period of the renewal grant, a third major area of research developed: inexact Newton and Newton iterative methods and their applications to large-scale nonlinear systems, especially those arising in discretized problems. An inexact Newton method is any method in which each step reduces the norm of the local linear model of the function of interest. A Newton iterative method is any implementation of Newton's method in which the linear systems that characterize Newton steps (the "Newton equations") are solved only approximately using an iterative linear solver. Newton iterative methods are properly considered special cases of inexact Newton methods. We describe the work in these areas and in other areas in this paper.

8396 (DOE/ER/25041–3) **Computer aided surface representation: Progress report, June 1, 1989–May 31, 1990.** Barnhill, R.E. Arizona State Univ., Tempe, AZ (United States). Dept. of Computer Science. 19 Feb 1990. 64p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER25041. Order Number DE92005418. Source: OSTI; NTIS; GPO Dep.

The central research problem of this project is the effective representation, computation, and display of surfaces interpolating to information in three or more dimensions. If the given information is located on another surface, then the problem is to construct a "surface defined on a surface". Sometimes properties of an already defined surface are desired, which is "geometry processing". Visualization of multivariate surfaces is possible by means of contouring higher dimensional surfaces. These problems and more are discussed below. The broad sweep from constructive mathematics through computational algorithms to computer graphics illustrations is utilized in this research. The breadth and depth of this research activity makes this research project unique.

8397 (IKE–4-133) **THEXSYST - a knowledge based system for the control and analysis of technical simulation calculations.** Burger, B. Stuttgart Univ. (Germany). Inst. fuer Kernenergetik und Energiesysteme. Jul 1991. 190p. (In German). Order Number DE92750140. Source: OSTI; NTIS (US Sales Only); INIS.

This system (THEXSYST) will be used for control, analysis and presentation of thermal hydraulic simulation calculations of light water reactors. THEXSYST is a modular system consisting of an expert shell with user interface, a data base, and a simulation program and uses techniques available in RSYST. A knowledge base, which was created to control the simulational calculation of pressurized water reactors, includes both the steady state calculation and the transient calculation in the domain of the depressurization, as a result of a small break loss of coolant accident. The methods developed are tested using a simulational calculation with RELAP5/Mod2. It will be seen that the application of knowledge base techniques may be a helpful tool to support existing solutions especially in graphical analysis. (orig./HP).

8398 (INDC(CCP)–343/L) **Method for evaluating non-consistent data using two statistical criteria.** Yaborov, Yu.F. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Nov 1991. 10p. Translation of a paper published in Yadernye Konstanty (Nuclear Constants 2, 1989) - Original report in Russian was distributed as INDC(CCP)-303/G. Translated by the IAEA. Order Number DE92615195. Source: OSTI; NTIS (US Sales Only); INIS.

The paper presents methods of identifying mismatched data and finding possible causes of their being mismatched by using a statistical criterion which highlights abnormal extreme values. Processing methods for systems of non-consistent data are suggested. 17 refs.

8399 (INIS-BR–2864) **Solution of parabolic differential equations by Laplace transformation with numerical inversion.** Peruzzo, E.M. Rio Grande do Sul Univ., Porto Alegre, RS (Brazil). Dept. de Engenharia Nuclear. 1984 22p. (In Portuguese). Order Number DE92614100. Source: OSTI; NTIS (US Sales Only); INIS.

The objective of this work is to present and to apply a method for solving parabolic differential equations using the Laplace transform with the numerical calculation of the inverse transform, which was proposed by Heydarian. This method was applied for solving problems in nuclear engineering and heat transfer which have known analytical solutions, it was verified results with errors less than 1%. (author).

8400 (INIS-BR–2876) **Probe code: a set of programs for processing and analysis of the left ventricular function - User's manual.** Piva, R.M.V. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica). Sao Paulo Univ., SP (Brazil). Inst. de Fisica. 1987 64p. (In Portuguese). Order Number DE92614104. Source: OSTI; NTIS (US Sales Only); INIS.

The User's Manual of the Probe Code is an addendum to the M.Sc. thesis entitled A Microcomputer System of Nuclear Probe to Check the Left Ventricular Function. The Probe Code is a software which was developed for processing and off-line analysis curves from the Left Ventricular Function, that were obtained in vivo. These curves are produced by means of an external scintigraph probe, which was collimated and put on the left ventricule, after a venous inoculation of Tc-99 m. (author).

8401 (INIS-BR–2881) **An iterative computer graphics system to simulate the three dimension tumor growth.** Conci, A. (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil)); Pedreira, C.E.; Wanderley, R.V.C.T. Sociedade Brasileira de Matematica Aplicada e Computacional, Rio de Janeiro, RJ (Brazil). 1989 2p.

(In Portuguese). (CONF-8909464–: 12. Brazilian congress of applied computational mathematics, Sao Jose do Rio Preto (Brazil), 4-8 Sep 1989). Order Number DE92614101. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. TUMOR CELLS/growth; COMPUTER GRAPHICS; IN VIVO; RADIOTHERAPY; GROWTH

8402 (INIS-mf-13026, pp. 339-340) **Data-acquisition system with serial link to PC(XT).** Khandwe, A.L. (Bhabha Atomic Research Centre, Bombay (India). Computer Div.); Mishra, V.M. Department of Atomic Energy, Bombay (India). 1990. 410p. (CONF-9012123–: DAE symposium on nuclear physics, Madras (India), 1-4 Dec 1990). In *DAE symposium on nuclear physics: contributed papers. Vol. 33B (1990)*. Order Number DE92001332. Source: OSTI; NTIS (US Sales Only); INIS.

Published in summary form only. DATA ACQUISITION SYSTEMS/analog-to-digital converters; MICROCOMPUTERS/data acquisition systems; DATA TRANSMISSION; DATA TRANSMISSION SYSTEMS; EQUIPMENT INTERFACES; MICROCOMPUTERS

8403 (INS-T–503) **The 7-th INS Scientific Computational Programs.** Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study. Jul 1991. 83p. (In Japanese). Order Number DE92750967. Source: OSTI; NTIS (US Sales Only); INIS.

Nineteen groups were accepted as the 7-th INS Scientific Computational Programs (ISCP). This ISCP can use full resources of the INS central computer without an operational limitation. The 7-th ISCP started at June/11/91 and ended at March/30/91. Some results were already published in journals or appeared in physical meetings. This is a sum of the used statistics of the 7-th ISCP and reports presented by groups performed the 7-th ISCP. (author).

8404 (IS-T–1589) **The work/exchange model: A generalized approach to dynamic load balancing.** Wikstrom, M.C. Ames Lab., IA (United States). 20 Dec 1991. 173p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-82. Order Number DE92005156. Source: OSTI; NTIS; GPO Dep.

A crucial concern in software development is reducing program execution time. Parallel processing is often used to meet this goal. However, parallel processing efforts can lead to many pitfalls and problems. One such problem is to distribute the workload among processors in such a way that minimum execution time is obtained. The common approach is to use a load balancer to distribute equal or nearly equal quantities of workload on each processor. Unfortunately, this approach relies on a naive definition of load imbalance and often fails to achieve the desired goal. A more sophisticated definition should account for the affects of additional factors including communication delay costs, network contention, and architectural issues. Consideration of additional factors led us to the realization that optical load distribution does not always result from equal load distribution. In this dissertation, we tackle the difficult problem of defining load imbalance. This is accomplished through the development of a parallel program model called the Generalized Work/Exchange Model. Associated with the model are equations for a restricted set of deterministically balanced programs that characterize idle time, elapsed time, and potential speedup. With the aid of the model, several common myths about load imbalance are exposed. A useful application called a load balancer enhancer is also presented which is applicable to the more general, quasi-static load unbalanced program.

8405 (KAERI/RR–934/90) **A study on the nuclear computer codes installation and management system.** Kim, Yeon Seung (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Huh, Young Hwan; Kim, Hee Kyung; Kang, Byung Heon; Kim, Ko Ryeo; Suh, Soong Hyok; Choi, Young Gil; Lee, Jong Bok. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Dec 1990. 103p. (In Korean). Order Number DE92615196. Source: OSTI; NTIS (US Sales Only); INIS.

From 1987 a number of technical transfer related to nuclear power plant had been performed from C-E for YGN 3 and 4 construction. Among them, installation and management of the computer codes for YGN 3 and 4 fuel and nuclear steam supply system was one of the most important project. Main objectives of this project are to establish the nuclear computer code management system, to develop QA procedure for nuclear codes, to secure the nuclear code reliability and to extend techanical applicabilities including the user-oriented utility programs for nuclear codes. Contents of performing the project in this year was to produce 215 transmittal packages of nuclear codes installation including making backup magnetic tape and microfiche for software quality assurance. Lastly, for easy reference about the nuclear codes information we presented list of code names and information on the codes which were introduced from C-E. (Author).

8406 (KAERI/RR–935/90) **A study on the nuclear computer code maintenance and management system.** Kim, Yeon Seung (Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of)); Huh, Young Hwan; Lee, Jong Bok; Choi, Young Gil; Suh, Soong Hyok; Kang, Byong Heon; Kim, Hee Kyung; Kim, Ko Ryeo; Park, Soo Jin. Korea Atomic Energy Research Inst., Daeduk (Korea, Republic of). Dec 1990. 206p. (In Korean). Order Number DE92615197. Source: OSTI; NTIS (US Sales Only); INIS.

According to current software development and quality assurance trends. It is necessary to develop computer code management system for nuclear programs. For this reason, the project started in 1987. Main objectives of the project are to establish a nuclear computer code management system, to secure software reliability, and to develop nuclear computer code packages. Contents of performing the project in this year were to operate and maintain computer code information system of KAERI computer codes, to develop application tool, AUTO-i, for solving the 1st and 2nd moments of inertia on polygon or circle, and to research nuclear computer code conversion between different machines. For better supporting the nuclear code availability and reliability, assistance from users who are using codes is required. Lastly, for easy reference about the codes information, we presented list of code names and information on the codes which were introduced or developed during this year. (Author).

8407 (KEK–91-3) **User's guide to DENKAI.** Shintake, Tsumoru. National Lab. for High Energy Physics, Tsukuba, Ibaraki (Japan). Jun 1991. 26p. Order Number DE92751022. Source: OSTI; NTIS (US Sales Only); INIS.

DENKAI is a set of computer program to calculate the 2-dimensional electrostatic field with cylindrical symmetry. Using simple commands, triangle meshes are automatically generated in MESH GENERATOR routine. The bandwidth of the coefficient matrix is reduced in the BAND WIDTH routine. The Laplace equation of the electrostatic field is solved in FIELD routine by inverting the coefficient matrix using Gauss method. The electric field lines are plotted by the FIELD PLOT routine, and the electric field intensities on arbitrary boundary can be read out by the FIELD LIST routine. (author).

8408 (MLM–3722) **Three-dimensional operational interpolation.** Silver, G.L. Mound, Miamisburg, OH (United States). 12 Dec 1991. 53p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-88DP43495. Order Number DE92004581. Source: OSTI; NTIS; GPO Dep.

The operational method for interpolating experimental data is extended into three dimensions. An exponential method or a polynomial method can be used. Equations for two pyramids and two prisms are derived as illustrations. 18 refs.

8409 (ORNL/ER–65) **Monitoring and modeling contaminated sediment transport in the White Oak Creek watershed: Environmental Restoration Program.** Fontaine, T.A. Oak Ridge National Lab., TN (United States). Nov 1991. 19p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC05-84OR21400. Order Number DE92004585. Source: OSTI; NTIS; GPO Dep.

Environmental Sciences Publication No. 3787.

Over the past 47 years, operations and waste disposal activities at Oak Ridge National Laboratory have resulted in the contamination of the White Oak Creek drainage system. The containments presenting the highest risk to human health and the environment are particle reactive and are associated with the soils and sediments in White Oak Creek. During floods, the erosion of these sediments results in the transport of contaminants out of the catchment into the Clinch River. A long-term strategy is required to monitor the movement of contaminated sediments and to predict the transport of these sediments that could occur during major floods. A monitoring program will provide the information required to (1) evaluate the existing off-site transport of contaminated sediments, (2) evaluate the need for short-term control measures, (3) set priorities for remediation of contaminated areas in White Oak Creek (4) verify the success of completed remedial actions intended to control the movement of contaminated sediments, and (5) develop a computer model to simulate the transport of contaminated sediments in White Oak Creek. A contaminant-transport model will be developed to (1) evaluate the potential for the off-site transport of contaminated sediments during major floods, (2) develop long term control measures and remediation solutions, (3) predict the impact of future land-use changes in White Oak Creek on the transport of contaminated sediment. This report contains a plan for the monitoring and modeling activities required to accomplish these objectives.

8410 (ORNL/TM–11797) **Survey of data compression techniques.** Gryder, R.; Hake, K. Oak Ridge National Lab., TN (United States). Sep 1991. 46p. Sponsored by U.S. Department of Defense. DOE Contract AC05-84OR21400. Order Number DE92004292. Source: OSTI; NTIS; GPO Dep.

PM-AIM must provide to customers in a timely fashion information about Army acquisitions. This paper discusses ways that PM-AIM can reduce the volume of data that must be transmitted between sites. Although this paper primarily discusses techniques of data compression, it also briefly discusses other options for meeting the PM-AIM requirements. The options available to PM-AIM, in addition to hardware and software data compression, include less-frequent updates, distribution of partial updates, distributed data base design, and intelligent network design. Any option that enhances the performance of the PM-AIM network is worthy of consideration. The recommendations of this paper apply to the PM-AIM project in three phases: the current phase, the target phase, and the objective phase. Each recommendation will be identified as (1) appropriate for the current phase, (2) considered for implementation during the target phase, or (3) a feature that should be part of the objective phase of PM-AIM's design. The current phase includes only those measures that can be taken with the installed leased lines. The target phase includes those measures that can be taken in transferring the traffic from the leased lines to the DSNET environment with minimal changes in the current design. The objective phase includes all the things that should be done as a matter of course. The objective phase for PM-AIM appears to be a distributed data base with data for each site stored locally and all sites having access to all data.

8411 (ORNL/TM–11899) **Discrete Pearson distributions.** Bowman, K.O. (Oak Ridge National Lab., TN (United States)); Shenton, L.R.; Kastenbaum, M.A. Oak Ridge National Lab., TN (United States). Nov 1991. 26p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE92004700. Source: OSTI; NTIS; GPO Dep.

These distributions are generated by a first order recursive scheme which equates the ratio of successive probabilities to the ratio of two corresponding quadratics. The use of a linearized form of this model will produce equations in the unknowns matched by an appropriate set of moments (assumed to exist). Given the moments we may find valid solutions. These are two cases; (1) distributions defined on the non-negative integers (finite or infinite) and (2) distributions defined on negative integers as well. For (1), given the first four moments, it is possible to set this up as equations of finite or infinite degree in the probability of a zero occurrence, the sth component being a product of s ratios of linear forms in this probability in general. For (2) the equation for the zero probability is purely linear but may involve slowly converging series; here a particular case is the discrete normal. Regions of validity are being studied. 11 refs.

8412 (ORNL/TM–11903) **A case against a divide and conquer approach to the nonsymmetric eigenvalue problem.** Jessup, E.R. Oak Ridge National Lab., TN (United States). Dec 1991. 28p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract AC05-84OR21400. Grant CCR-9109785. Order Number DE92004086. Source: OSTI; NTIS; GPO Dep.

Divide and conquer techniques based on rank-one updating have proven fast, accurate, and efficient in parallel for the real symmetric tridiagonal and unitary eigenvalue problems and for the bidiagonal singular value problem. Although the divide and conquer mechanism can also be adapted to the real nonsymmetric eigenproblem in a straightforward way, most of the desirable characteristics of the other algorithms are lost. In this paper, we examine the problems of accuracy and efficiency that can stand in the way of a nonsymmetric divide and conquer eigensolver based on low-rank updating. 31 refs., 2 figs.

8413 (ORNL/TM–11934) **Information survey for microcomputer systems integration.** Hake, K.A. Oak Ridge National Lab., TN (United States). Dec 1991. 21p. Sponsored by U.S. Department of Defense. DOE Contract AC05-84OR21400. Order Number DE92004021. Source: OSTI; NTIS; GPO Dep.

One goal of the PM-AIM is to provide US Army Project Managers (PMs) and Project Executive Officers (PEOs) with a fundamental microcomputing resource to help perform acquisition information management and its concomitant reporting requirements. Providing key application software represents one means of accomplishing this goal. This workstation would furnish a broad range of capabilities needed in the PM and PEO office settings as well as software tools for specific project management and acquisition information. Although still in the conceptual phase, the practical result of this exercise in systems integration will likely be a system called the Project Manager's Information System (PMIS) or the AIM workstation. It would include such software as, Project Manager's System Software (PMSS), Defense Acquisition Executive Summary (DAES), and Consolidated Acquisition Reporting System (CARS) and would conform to open systems architecture as accepted by the Department of Defense. ORNL has assisted PM-AIM in the development of technology ideas for the PMIS workstation concept. This paper represents the compilation of information gained during this process. This information is presented as a body of knowledge (or knowledge domain) defining the complex technology of microcomputing. The concept of systems integration or tying together all hardware and software components reflects the nature of PM-AIM's task in attempting to field a PMIS or AIM workstation.

8414 (ORNL/TM–11951) **GRESS Version 2.0 user's manual.** Horwedel, J.E. Oak Ridge National Lab., TN (United States). Nov 1991. 106p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC05-84OR21400. Order Number DE92004592. Source: OSTI; NTIS; GPO Dep.

GRESS uses a precompiler to interpret FORTRAN statements and determine the mathematical operations embodied in them. As each arithmetic assignment statement in a program is interpreted, information necessary to allow the calculation of derivatives is generated. The result of the precompilation step is a new FORTRAN program that can produce derivatives for any REAL (i.e., single or double precision) variable calculated by the model. Consequently, GRESS enhances FORTRAN programs or subprograms by adding the calculation of derivatives along with the original output. Derivatives from a GRESS enhanced model can be used internally (e.g., iteration acceleration) or externally (e.g., sensitivity studies). By calling GRESS run-time routines, derivatives can be propagated through the code via the chain rule (referred to as the CHAIN option) or accumulated to create an adjoint matrix (referred to as the ADGEN option). A third option, GENSUB, makes it possible to process a subset of a program (i.e., a do loop, subroutine, function, a sequence of subroutines, or a whole program) for calculating derivatives of dependent variables with respect to independent variables.

8415 (ORNL/TM–11960) **Block sparse Cholesky algorithms on advanced uniprocessor computers.** Ng, E.G.; Peyton, B.W. Oak Ridge National Lab., TN (United States). Dec 1991. 35p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE92004167. Source: OSTI; NTIS; GPO Dep.

As with many other linear algebra algorithms, devising a portable implementation of sparse Cholesky factorization that performs well on the broad range of computer architectures currently available is a formidable challenge. Even after limiting our attention to machines with only one processor, as we have done in this report, there are still several interesting issues to consider. For dense matrices, it is well known that block factorization algorithms are the best means of achieving this goal. We take this approach for sparse factorization as well. This paper has two primary goals. First, we examine two sparse Cholesky factorization algorithms, the multifrontal method and a blocked left-looking sparse Cholesky method, in a systematic and consistent fashion, both to illustrate the strengths of the blocking techniques in general and to obtain a fair evaluation of the two approaches. Second, we assess the impact of various implementation techniques on time and storage efficiency, paying particularly close attention to the work-storage requirement of the two methods and their variants.

8416 (ORNL/TM-11986) **NA-NET numerical analysis net.** Dongarra, J. (Tennessee Univ., Knoxville, TN (United States). Dept. of Computer Science); Rosener, B. Oak Ridge National Lab., TN (United States). Dec 1991. 30p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE92004166. Source: OSTI; NTIS; GPO Dep.

This report describes a facility called NA-NET created to allow numerical analysts (na) an easy method of communicating with one another. The main advantage of the NA-NET is uniformity of addressing. All mail is addressed to the Internet host "na-net.ornl.gov" at Oak Ridge National Laboratory. Hence, members of the NA-NET do not need to remember complicated addresses or even where a member is currently located. As long as moving members change their e-mail address in the NA-NET everything works smoothly. The NA-NET system is currently located at Oak Ridge National Laboratory. It is running on the same machine that serves netlib. Netlib is a separate facility that distributes mathematical software via electronic mail. For more information on netlib consult, or send the one-line message "send index" to netlib@ornl.gov. The following report describes the current NA-NET system from both a user's perspective and from an implementation perspective. Currently, there are over 2100 members in the NA-NET. An average of 110 mail messages pass through this facility daily.

8417 (ORNL/TM-12003) **A parallel algorithm for the nonsymmetric eigenvalue problem.** Dongarra, J. (Tennessee Univ., Knoxville, TN (United States). Dept. of Computer Science); Sidani, M. Oak Ridge National Lab., TN (United States). Dec 1991. 52p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE92004087. Source: OSTI; NTIS; GPO Dep.

This paper describes a parallel algorithm for computing the eigenvalues and eigenvectors of a non-symmetric matrix. The algorithm is based on a divide-and-conquer procedure and uses an iterative refinement technique.

8418 (ORNL/TM-12006) **Reduction to condensed form for the eigenvalue problem on distributed memory architectures.** Dongarra, J.J. (Tennessee Univ., Knoxville, TN (United States). Dept. of Computer Science); van de Geijn, R.A. Oak Ridge National Lab., TN (United States). Jan 1992. 20p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract AC05-84OR21400. Order Number DE92004291. Source: OSTI; NTIS; GPO Dep.

In this paper, we describe a parallel implementation for the reduction of general and symmetric matrices to Hessenberg and tridiagonal form, respectively. The methods are based on LAPACK sequential codes and use a panel-wrapped mapping of matrices to nodes. Results from experiments on the Intel Touchstone Delta are given.

8419 **Video image position determination.** Christensen, W.; Anderson, F.L.; Kortegaard, B.L. To Dept. of Energy. 1990. Filed date 2 Apr 1990. USA Patent patent application 7-502,959. 30p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE92003834. Source: OSTI; NTIS; GPO Dep.

The present invention generally relates to the control of video and optical information and, more specifically, to control systems utilizing video images to provide control. Accurate control of video images and laser beams is becoming increasingly important as the use of lasers for machine, medical and experimental processes escalates. In, AURORA, an installation at Los Alamos National Laboratory dedicated to laser fusion research, it is necessary to precisely control the path and angle of up to 96 lasers beams. This invention is comprised of an optical beam position controller in which a video camera captures an image of the beam in its video frames, and conveys those images to a processing board which calculates the centroid coordinates for the image. The image coordinates are used by motor controllers and stepper motors to position the beam in a predetermined alignment. In one embodiment, system noise, used in conjunction with Bernoulli trials, yields higher resolution centroid coordinates.

8420 (SAND-91-1633C) **Wavenumber-domain SAR focusing from a nonuniform synthetic aperture.** Flynn, T.J. Sandia National Labs., Albuquerque, NM (United States). [1991]. 12p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-920354-1: 1992 IEEE international conference on acoustics, speech and signal processing, San Francisco, CA (United States), 23-26 Mar 1992). Order Number DE92003640. Source: OSTI; NTIS; GPO Dep.

In the wavenumber-domain concept of SAR imaging, frequency-domain radar data are used to reconstruct a portion of the 2-D Fourier transform of the scene, which is then inverted to create the image. The method suffers no inherent limits on aperture length or scene size. This paper extends the concept to the case where the synthetic aperture is not a straight line and the samples are unevenly spaced. An accumulation formula for wavenumber-domain reconstruction is derived and shown to be equivalent to previously derived algorithms in the uniform-aperture case. It is then shown how data with three-dimensional irregularity in the aperture can be processed using height correction and mapping into the same plane. 10 refs., 3 figs.

8421 (SAND-91-1752) **PHYSLIB: A C++ tensor class library.** Budge, K.G. Sandia National Labs., Albuquerque, NM (United States). 9 Oct 1991. 86p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE92004113. Source: OSTI; NTIS; GPO Dep.

C++ is the first object-oriented programming language which produces sufficiently efficient code for consideration in computation-intensive physics and engineering applications. In addition, the increasing availability of massively parallel architectures requires novel programming techniques which may prove to be relatively easy to implement in C++. For these reasons, Division 1541 at Sandia National Laboratories is devoting considerable resources to the development of C++ libraries. This document describes the first of these libraries to be released, PHYSLIB, which defines classes representing Cartesian vectors and (second-order) tensors. This library consists of the header file physlib.h, the inline code file physlib.inl, and the source file physlib.C. The library is applicable to both three-dimensional and two-dimensional problems; the user selects the 2-D version of the library by defining the symbol TWO D in the header file physlib.h and recompiling physlib.C and his own code. Alternately, system managers may wish to provide duplicate header and object modules of each dimensionality. This code was produced under the auspices of Sandia National Laboratories, a federally-funded research center administered for the United States Department of Energy on a non-profit basis by AT&T. This code is available to US citizens, and institutions under research, government use and/or commercial license agreements.

8422 (SAND-91-2864) **SANET 1.0 User's Guide and Reference Manual.** Camp, A.L. (Sandia National Labs., Albuquerque, NM (United States)); Abeyta, L.P. Sandia National Labs., Albuquerque, NM (United States). Dec 1991. 45p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE92005563. Source: OSTI; NTIS; GPO Dep.

SANET is a computer program intended for use in constructing, evaluating, and printing event trees for safety and reliability studies. SANET allows the user to graphically construct event trees, assign probabilities to the branches on the tree and include a variety of labels. Fast, publication quality printed output can be obtained. SANET requires an IBM compatible PC with a 80286, 80386 or 80486 processor, VGA graphics, a mouse and an HP Laserjet printer.

8423 (SKB-TR-91-18) **Numerical inversion of Laplace transforms using integration and convergence acceleration.** Gustafson, S.Aa. (Rogaland Univ., Stavanger (Norway)). Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). May 1991. 70p. Order Number DE92614105. Source: OSTI; NTIS (US Sales Only); INIS.

This report describes a computational scheme for the numerical inversion of Laplace transforms in the case when all singularities occur on the real line. The determination of the value of the inverse function at a given point t proceeds in four major steps: * Using the Bromwich inversion formula the inverse is represented as an integral over an infinite interval. * By means of the trapezoidal rule this integral is written as an infinite sum. * The sum is converted to a power series. * This power series is evaluated using convergence acceleration. In order to carry out the last step in an efficient way an aggregation of terms is employed to ensure stability and rapid convergence. The truncation error decreases exponentially with the number of terms used and this fact may be exploited in error estimation and the selection of corresponding parameters in the computer programs. If certain general conditions are satisfied, then only a finite number of parameters is required to specify a function with a preselected accuracy. Thus the values of the inverse transform are calculated on a finite grid, and the transform is determined at all other points with interpolation. It is described how to construct the grid to guarantee that the resulting error does not surpass a bound, defined by the user. An inversion routine based on the ideas put forth in this report has been developed for use with the PROPER code package. (au).

8424 (SKB-TR-91-19) **NEAR21 - A near field radionuclide migration code for use with the PROPER package.** Norman, S. (Starprog AB (Sweden)); Kjellbert, N. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Apr 1991. 39p. Order Number DE92614106. Source: OSTI; NTIS (US Sales Only); INIS.

The near field radionuclide migration computer code NEAR21 has been developed as a submodel of the probabilistic package PROPER, and can be considered a PROPER version of the near field models used in the KBS-3 study. NEAR21 computes the migration rates of radionuclide chains from the near field of one KBS-3 canister. Diffusive transport, canister corrosion, fuel matrix dissolution, solubility limitations under oxidizing and reducing conditions, washout of instantly released portions of the inventories and chain decay are all taken into account. (au).

8425 (SKB-TR-91-26) **Testing of parameter averaging techniques for far-field migration calculations using FARF31 with varying velocity.** Bengtsson, A. (Kemakta Consultants Co., Stockholm (Sweden)); Boghammar, A.; Grundfelt, B.; Rasmuson, A. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Jun 1991. 49p. Order Number DE92614107. Source: OSTI; NTIS (US Sales Only); INIS.

This report was prepared for SKB as a part of the SKB 91 performance assessment study. The object of the study was to test different averaging techniques for averaging velocity profiles. The average velocities obtained with the different techniques were used to set appropriate values on the Peclet number, Pe, and the groundwater travel time t_w, and used as input to the FARF31 code. The output from the FARF31 calculations were compared against numerical simulations made with TRUCHN. Three different averaging techniques were tested: volume averaging, flow averaging and a technique based on the principle of additive variances. Four different nuclides were studied, ^{238}U, ^{237}Np, ^{135}Cs and ^{129}I. Five velocity profiles were tested, four generic profiles and one particle track from the groundwater flow calculations made for the Finnsjoe site. (au).

8426 (SKB-TR-91-27) **Verification of HYDRASTAR - A code for stochastic continuum simulation of groundwater flow.** Norman, S. (Starprog AB (Sweden)). Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Jul 1991. 74p. Order Number DE92614108. Source: OSTI; NTIS (US Sales Only); INIS.

HYDRASTAR is a code developed at Starprog AB for use in the SKB 91 performance assessment project with the following principal function: Reads the actual conductivity measurements from a file created from the data base GEOTAB. Regularizes the measurements to a user chosen calculation scale. Generates three dimensional unconditional realizations of the conductivity field by using a supplied model of the conductivity field as a stochastic function. Conditions the simulated conductivity field on the actual regularized measurements. Reads the boundary conditions from a regional deterministic NAMMU computation. Calculates the hydraulic head field, Darcy velocity field, stream lines and water travel times by solving the stationary hydrology equation and the streamline equation obtained with the velocities calculated from Darcy's law. Generates visualizations of the realizations if desired. Calculates statistics such as semivariograms and expectation values of the output fields by repeating the above procedure by iterations of the Monte Carlo type. When using computer codes for safety assessment purpose validation and verification of the codes are important. This report describes a work performed with the goal of verifying parts of HYDRASTAR. The verification described uses comparisons with two other solutions of related examples: Comparison with a so called perturbation solution of the stochastical stationary hydrology equation. This as an analytical approximation of the stochastical stationary hydrology equation valid in the case of small variability of the unconditional random conductivity field. Comparison with the (Hydrocoin, 1988), case 2. This is a classical example of a hydrology problem with a deterministic conductivity field. The principal feature of the problem is the presence of narrow fracture zones with high conductivity. The compared output are the hydraulic head field and a number of stream lines originating from a set of given positions.

8427 (SKB-TR-91-30) **A resistance network model for radionuclide transport into the near field surrounding a repository for nuclear waste (SKB, Near Field Model 91).** Nilsson, L. (Royal Institute of Technology, Stockholm (Sweden). Dept. of Chemical Engineering); Moreno, L.; Neretnieks, I.; Romero, L. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Jun 1991. 77p. Order Number DE92614109. Source: OSTI; NTIS (US Sales Only); INIS.

A model has been developed, describing the steady state transport of dissolving species of radionuclides from a single canister in a repository for spent nuclear fuel out into the passing water in fractures in the surrounding rock matrix. The transport of nuclides is described by a network of transport resistances, coupled together in the same way as an electrical circuit network. With the model a number of calculations are done for various sets of fracture geometry data. The calculations indicate that the resistance network model gives results comparable to those of a complex 3-dimensional numerical model. (au).

8428 (SKB-TR-91-31) **Near field studies within the SKB 91 Project.** Widen, H. (Kemakta Consultants AB, Stockholm (Sweden)); Bengtsson, A.; Grundfelt, B. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Jun 1991. 66p. Order Number DE92614110. Source: OSTI; NTIS (US Sales Only); INIS.

A number of near field studies was preformed during the early part of the SKB91 project. This report summaries this work and includes: - Simulation of the steady release from the near field with different time for canister penetration. - Simulation of the release from a repository with 5300 canisters with different penetration times for different parts of the canisters due to manufacturing error, glaciations, inner over pressure and corrosion. - Calculation with a numerical model of the transient release of the instantaneously dissolvable species and the effect of different boundary conditions both at the canister/bentonite and the bentonite/rock interface. - Description of the implementation of a resistance network model for the calculation of the steady state transport resistances in the different pathways from the canisters. - Comparison of two analytical models for the calculation of the release of the instantaneously dissolvable species. (au).

8429 (UCRL-53868-90, pp. 2.7-2.11) **Solution strategies for implicit, nonlinear finite element analysis.** Whirley, R.G.; Engelmann, B.E. Lawrence Livermore National Lab., CA (United

States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

The development of effective solution strategies to solve the global nonlinear equations which arise in implicit finite element analysis is an important area of research, and it is the subject of this investigation. Efficient strategies make good use of computational resources, and allow larger and more complex analysis models to be studied. Robust algorithms are essential to handle the complex nonlinearities which arise in many LLNL applications, such as metalforming process simulation. The authors research indicates that robustness can be best achieved in a general setting through adaptive solution strategies. This adaptivity and flexibility has been incorporated into NIKE2D through the development of ISLAND (Interactive Solution Language for an Adaptive Nike Driver). These new solution control features make NIKE2D a smart code, and permits us to address many new and challenging problems.

8430 (UCRL–53868-90, pp. 8.228.26) **Signal and image processing software development.** Brase, J.M.; Gavel, D.T.; Wieting, M.G.; Sherwood, R.J.; Hernandez, J.E. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

Software development projects sponsored by the Remote Sensing, Imaging, and Signal Engineering (RISE) thrust area have produced a set of tools which have been applied to a variety of signal and image processing problems at LLNL and the world at learge. These general-purpose tools apply to a broad set of applications that include remote sensing, weapons, test diagnostics, and nondestructive evaluation. The tools also form a capability base that attracts new applciations with the potential to build new LLNL programs. The authors have distributed these signal and image processing systems successfully to codevelopers around the world. They are using these systems for applications in government agencies and private industry and as teaching tools in universities. The outside contacts and the many new ideas they have fostered have enriched their program and their development efforts. They have continued the development of three image and signal processing software systems - View, ISLE (Image and Signal Processing LISP Environment), and Mat/C - adding new functions, tools, and options, increasing portability, and publishing new documentation.

8431 (UCRL–53868-90, pp. 8.27-8.34) **Real-time multidimensional signal processing technology.** Roberson, G.P.; Azevedo, S.G.; Current, K.W.; Hurst, P.J. Lawrence Livermore National Lab., CA (United States). Aug 1991. In *Engineering research and development thrust area report, FY 90.* 246p. Order Number DE92000519. Source: OSTI; NTIS (US Sales Only).

The authors are developing high performance implementations of a two- and three-dimensional signal processing algorithm, the Radon transform. They have taken three different approaches to this challenge. The first approach is the Radon Transform Processor (RTP) which uses a multi-processor arrangement of commercial chips to perform a rapid Radon transform and its inverse for image reconstruction. The second is the design of a custom CMOS VLSI chip capable of 2-D image processing at a 27- to 50-MHz data rate. These first two projects were undertaken at the University of California at Davis, and have delivered solutions to the fast implementation of the 2-D Radon transform. The third approach is the development of hardware at LLNL to overcome the increasingly critical 3-D image processing problem. They have designed a special purpose coprocessor to perform 3-D image reconstructions from Radon space.

8432 (UCRL-ID–106314) **Limit of sensitivity of low-background counting equipment.** Homann, S.G. Lawrence Livermore National Lab., CA (United States). 8 Oct 1991. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE92004629. Source: OSTI; NTIS; INIS; GPO Dep.

The Hazards Control Department's Radiological Measurements Laboratory (RML) analyzes many types of sample media in support of the Laboratory's health and safety program. The Department has determined that the equation for the minimum limit of sensitivity, $MDC(\alpha,\beta) = 2.71 + 3.29\ (r_b t_s)^{\frac{1}{2}}$ is also adequate for RML counting systems with very-low-background levels. This paper reviews the normal distribution case and address the special case of determining the limit of sensitivity of a counting system when the background count rate is well known and small. In the latter case, we must use an exact test procedure based on the binomial distribution. However, the error in using the normal distribution for calculating a detection system's limit of sensitivity is not significant even as the total observed number of counts approaches or equals zero. 2 refs., 4 figs.

8433 (UCRL-ID–108228) **General purpose parallel supercomputing.** Nielsen, D.E. Jr. Lawrence Livermore National Lab., CA (United States). 19 Jun 1991. 12p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE92004631. Source: OSTI; NTIS; GPO Dep.

Recent advances in the hardware and software of parallel computers have opened up two new opportunities to focus programmatic resources. First, these new machines enable the smooth transition of an organization's general purpose computing load onto massively parallel processors. Second, these advances allow "capability" machines to economically serve the "capacity" needs of a large research or industrial organization. 6 figs.

8434 (UCRL-JC–104008) **SISAL reference manual: Language version 2.0.** Oldehoeft, R.R. (ed.) (Colorado State Univ., Fort Collins, CO (United States). Dept. of Computer Science); Boehm, A.P.W.; Grit, D.H.; Cann, D.C. (ed.); Feo, J.T. Lawrence Livermore National Lab., CA (United States). May 1990. 127p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-48. (CONF-9006328–2: Asilomar conference on circuits, systems, and computers, Pacific Grove, CA (United States), 5-8 Jun 1990). Order Number DE92004660. Source: OSTI; NTIS; GPO Dep.

In this report we describe the SISAL 2.0 programming language. The project began in 1982 as a cooperative venture by Digital Equipment Corporation, the University of Manchester (England), Lawrence Livermore National Laboratory, and Colorado State University. The project's goals evolved to become: Define a general-purpose functional language that can run efficiently on conventional and novel parallel architectures; define a dataflow graph intermediate form independent of language and target architecture; develop optimization techniques for high-performance applicative computing;develop a thread management environment to support dataflow-style parallel computing on conventional shared-memory multiprocessors; achieve sequential and parallel execution performance competitive with programs written in conventional languages; and validate the functional style of programming for large-scale scientific applications.

8435 (UCRL-JC–104491) **Bumps and potholes on the road to network computing.** Watson, R.W. Lawrence Livermore National Lab., CA (United States). Jul 1990. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9004179–2: Cray users group conference, Toronto (Canada), Apr 1990). Order Number DE92003977. Source: OSTI; NTIS; GPO Dep.

Network computing in a supercomputer environment offers the potential to improve user productivity and enable users to take advantage of the rapidly improving cost/performance of microelectronics through use of hierarchies of processing, storage, I/O and communication resources. Our experience to date indicates that to realize the potential will not only require improvements in operating systems and programming environments, but more importantly will require very high availability networks and a new support infrastructure. This paper outlines some of the potholes and bumps we have run into during recent years in our goal to make network computing an everyday reality for our user community. While some recommendations are made that can smooth the ride, most of the potholes and bumps yet remain to be leveled. 2 figs.

8436 (UCRL-JC–108590) **Software tools for distributed intelligent control systems.** James, J.R. (Army Training and Doctrine Command, Fort Monroe, VA (United States)); Herget, C.J. Lawrence Livermore National Lab., CA (United States). Oct 1991.

7p. Sponsored by U.S. DOE Environment Safety & Health. DOE Contract W-7405-ENG-48. (CONF-9109316–2: 3. International Federation of Automatic Control (IFAC) international workshop on artificial intelligence in real time control, Phonert Park, CA (United States), 23-25 Sep 1991). Order Number DE92004656. Source: OSTI; NTIS; GPO Dep.

The future of intelligent control systems depends upon the extent to which Artificial Intelligence (AI) technology can help control engineers deliver practical solutions to difficult control engineering problems. Conventional control design approaches have achieved notable successes in the design and implementation of robust, adaptive controllers for systems with well-defined mathematical models. However, conventional approaches have had difficulty supporting engineers in the design and implementation of control systems when an accurate mathematical model is not available. Also, verification that computer-controlled systems perform to specifications, validation of the specifications, higher-level control, operator decision aids, system diagnosis, operator alerting, and reconfiguration of systems which experience large changes over time or potentially catastrophic failures are significant challenges to control science and engineering. It is in these difficult areas where the AI technologies of knowledge representation, learning, search, diagnosis, planning, and decision are being used to aid control engineers. Algorithms for computer-controlled systems and software tools to help implement these algorithms have been a subject of research and commercialization for decades. Computer-Aided Control Engineering (CACE) tools have achieved a degree of success in the past decade based on their ability to assist in the control system design and implementation process. Specialized tools have been made available for system identification, system simulation, controller design and controller implementation. Recently, efforts have been made to build integrated CACE environments. This paper will describe the results of the workshop and subsequent efforts to use these results to shape a DARPA software development project.

8437 (UCRL-JC–108648) **Developing a broader basis for scientific data analysis interfaces.** Springmeyer, R.R.; Blattner, M.M.; Max, N.L. Lawrence Livermore National Lab., CA (United States). [1991]. 8p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9105285–2: CHI '92, Monterey, CA (United States), 3-7 May 1991). Order Number DE92003963. Source: OSTI; NTIS; GPO Dep.

Typical interfaces for recent scientific data analysis tools have emphasized visualization. Their focus on images can obscure the goal of the scientific data analysis process, which is an understanding of some physical phenomenon. We present the results of a two-phase study of this process, undertaken to inform the design of analysis tools with a broader basis. In the first phase, scientists from several disciplines were interviewed and observed while analyzing their own data. The observations exposed elements of scientific data analysis such as quantitative queries and comparisons, simple calculations, data culling, and record keeping. These elements form the basis of a scientific data analysis description which extends beyond image viewing. The second phase demonstrates how this broader understanding can be applied, with the design and implementation of a tool for culling regions of interest from large, complex data sets. Observations of the prototype tool in use reveal the effectiveness of a quantitative approach to culling complex data sets. The results of this study are three-fold: a method for studying a single-person process, a description of the fundamental elements of scientific data analysis, and a successful demonstration of applying this broader knowledge with a prototype implementation. 13 refs., 4 figs.

8438 (UCRL-JC–108711) **LLNL experience with HIPPI.** Getchell, D. Lawrence Livermore National Lab., CA (United States). Oct 1991. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-9109276–8: Visions of supercomputing conference, Santa Fe, NM (United States), 23-27 Sep 1991). Order Number DE92004658. Source: OSTI; NTIS; GPO Dep.

The High Performance Switching System Program (HPSS) at the Lawrence Livermore National Laboratory is in the process of implementing a gigabit Local Area Network featuring cross bar switches that interface to HIPPI, VME, and NuBus adapters. This paper presents a brief review of the design of the HPSS network, discusses our experiences with using HIPPI as an interconnect in a Local Area Network and describes our efforts to achieve maximum performance from our Model C and D IOS Cray systems.

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Refer also to citation(s) 6098, 6639, 6804, 7464, 7541, 7773, 8381, 8385, 8388, 8394, 8413

8439 (CONF-9110249–1) **Text encoding for retrieving scientific and technical information.** Strehlow, R.A.; Tallant, T.O.; Mason, J.D.; Kienlen, P.L. Oak Ridge National Lab., TN (United States). [1991]. 19p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From International symposium on terminology and documentation in specialized communication; Ontario, (Canada); 7-8 Oct 1991. Order Number DE92004403. Source: OSTI; NTIS; GPO Dep.

The authors have recently proposed a method a manage and to retrieve scientific and technical information based on the encoding of information within the document using Standard Generalized Markup Language (SGML). The encoding will include the scientific and technical information, as well as associated and ancillary scientific data, management data, and other metadata. The work proposed at the Oak Ridge National Laboratory will include tagset selection, document type definition writing, test document encoding, and programming that will permit various views of a document to be made. This paper describes the proposed method and work. Precise retrieval of contained information is conventionally done by means of Boolean searches to retrieve a set of documents that have been probability of containing the desired information. Standardized terminologies have long been a key element in constructing efficient search plans for these searches. Combined with added techniques of corpus selection, author or institution restriction, etc., effective searches can often be constructed. With the increase in corpus size, however, the standard methods become progressively less effective. The planned method described here involves a radically different approach to the retrieval problems. Its objective is the direct retrieval of information. The work of this study will be carried out by a multi-disciplinary team of engineering, scientific, publication, and information specialists. Computer programs to retrieve information from encoded sample documents will be either acquired or written and then tested. At the final stage of the work, after evaluation of the program, plans will be developed to apply the method to a wide range of specialized fields.

8440 (DOE/ER/25063–T11) **The ADAMS interactive dictionary browser.** Segal, B.M. Virginia Univ., Charlottesville, VA (United States). Dept. of Computer Science. 17 Dec 1990. 27p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-88ER25063. Order Number DE91014347. Source: OSTI; NTIS; GPO Dep.

The ADAMS-IDB is concerned with the structure created by the user's DDL statements and provides a graphically interactive environment to facilitate searching the schema. This paper gives a brief overview of ADAMS and presents the terminology that is necessary for a user of the ADAMS-IDB. Section 3 discusses the ADAMS-IDB itself. First, a description of the tool is given followed by a discussion of why and how the tool was developed. Section 4 discusses how the browser is structured. Section 5 discusses some observations the developer had concerning the ADAMS project in general while building the graphical interface. Section 6 is a User Guide which examines the ADAMS-IDB's graphical interface from a user point of view and steps the user through invocation, browsing, and termination of the ADAMS-IDB. Finally, Section 7 describes the output displayed by the browser and walks through an example of its usage. 5 refs., 9 figs.

8441 (K/CSD/TM–93-Rev.1) **Project Records Information System (PRIS) user's manual: Revision 1.** Smith, P.S.; Nations, J.A.; Short, R.D. Oak Ridge K-25 Site, TN (United States). Aug 1991. 72p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OT21400. Order Number DE92000149. Source: OSTI; NTIS; GPO Dep.

The Projects Record Information System (PRIS) is an interactive system developed for the Information Services Division (ISD) of Martin Marietta Energy Systems, Inc., to perform indexing, maintenance, and retrieval of information about Engineering project record documents for which they are responsible. This PRIS User's Manual provides instruction on the use of this system. Section 2.0 of this manual presents an overview of PRIS, describing the system's purpose; the data that it handles, functions it performs; hardware, software, and access; and help and error functions. Section 3.0 describes the interactive menu-driven operation of PRIS. Appendixes A, B,C, and D contain the data dictionary, help screens, report descriptions, and a primary menu structure diagram, respectively.

8442 (K/CSD/TM–95/Rev.1) **Engineering Design Information System (EDIS) user' manual: Revision 1.** Smith, P.S.; Short, R.D. Oak Ridge K-25 Site, TN (United States). Nov 1991. 89p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OT21400. Order Number DE92004110. Source: OSTI; NTIS; GPO Dep.

This manual is a guide to the use of the Engineering Design Information System (EDIS). The system runs on the Martin Marietta Energy Systems, Inc., IBM 3084 unclassified computer. EDIS is in the second phase of implementation, which provides an index, storage, and retrieval system for engineering documents produced at various plants and laboratories operated by Energy Systems for the Department of Energy (DOE). The second phase also provides additional hard copy request functionality. Section 2.0 of this manual presents an overview of EDIS, describing the system's purpose; the functions it performs; hardware, software, and security requirements; and help and error functions. Section 3.0 describes how to access EDIS and how to operate system functions using Database 2 (DB2), Time Sharing Option (TSO), Interactive System Productivity Facility (ISPF), Soft Master viewing, and FT/Express file transfer features employed by this system. Appendix A lists the special hardware and software requirements that must be met to run the View function. Appendix B contains a description of the Soft Master viewing capabilities provided through the EDIS View function. Appendix C contains a list of special hardware and software requirements for the Store and Download functions of EDIS. Appendix D provides examples of the system error screens and help screens for valid codes used for screen entry. Appendix E contains a dictionary of data elements and descriptions.

8443 (LBL–30104) **Problems underlying the use of referential integrity mechanisms in relational database management systems.** Markowitz, V.M. Lawrence Berkeley Lab., CA (United States). Dec 1990. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-9104321–1: 7. IEEE international conference on data engineering, Kobe (Japan), 8-12 Apr 1991). Order Number DE92004304. Source: OSTI; NTIS; GPO Dep.

Referential integrity is used in relational data-bases for expressing existence dependencies between tuples. Relational database management systems (RDBMS) provide diverse referential integrity capabilities. Thus, is some RDBMSs referential integrity constraints can be specified non-procedurally (declaratively), while in other RDBMSs they must be specified procedurally. Moreover, some RDBMSs restrict the class of allowed referential integrity constraints. We examine in this paper the main problems underlying the use of referential integrity mechanisms in three representative RDBMSs, DB2, SYBASE, and INGRES. 11 refs.

8444 (LRP–430/91) **Neural networks in front-end processing and control.** Lister, J.B. (Ecole Polytechnique Federale, Lausanne (Switzerland). Centre de Recherche en Physique des Plasma (CRPP)); Schnurrenberger, H.; Staeheli, N.; Stockhammer, N.; Duperrex, P.A.; Moret, J.M. Ecole Polytechnique Federale, Lausanne (Switzerland). Centre de Recherche en Physique des Plasma (CRPP). Jul 1991. 9p. (CONF-9106122–: 7. international conference on real time computer applications in nuclear, particle and plasma physics, Juelich (Germany), 18-28 Jun 1991). Order Number DE92614099. Source: OSTI; NTIS (US Sales Only); INIS.

Invited paper presented at the 7. conference real time '91, at KFA Juelich, FRG, 24-28 Jun 1991.

Research into neural networks has gained a large following in recent years. In spite of the long term timescale of this Artificial Intelligence research, the tools which the community is developing can already find useful applications to real practical problems in experimental research. One of the main advantages of the parallel algorithms being developed in AI is the structural simplicity of the required hardware implementation, and the simple nature of the calculations involved. This makes these techniques ideal for problems in which both speed and data volume reduction are important, the case for most front-end processing tasks. In this paper we illustrate the use of a particular neural network known as the Multi-Layer Perceptron as a method for solving several different tasks, all drawn from the field of Tokamak research. We also briefly discuss the use of the Multi-Layer Perceptron as a non-linear controller in a feedback loop. We outline the type of problem which can be usefully addressed by these techniques, even before the large-scale parallel processing hardware currently under development becomes cheaply available. We also present some of the difficulties encountered in applying these networks. (author) 13 figs., 9 refs.

8445 (MLM–3711) **Collection, presentation, and analysis of inspection data.** Applegate, C.A.; Tibbs, M.A.; Ratliff, L.R.; Wyder, W.C. Mound, Miamisburg, OH (United States). 6 Nov 1991. 50p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-88DP43495. Order Number DE92003738. Source: OSTI; NTIS; GPO Dep.

The handling of large volumes of inspection data printouts was a problem in PM Building, where the inspection data were being generated from Computer Numerical Controlled Coordinate Measuring Machines (CMM). The inspection of a group of 600 pieceparts could generate a stack of printer paper five to six inches high. To collect only the useful data from the inspections, a change to the CMM software was purchased, which allows the transfer of only measurement data to a second computer. From the second computer, the data are saved in a tabular format to a floppy disk, using a piece of software created especially for this purpose. The floppy disk is then used to transfer the data to a computer workstation where it is made presentable and analyzed in a LOTUS spreadsheet. From the analysis, the inspected product can be accepted or rejected; the capability of the process can be determined; and finally, future inspection requirements can be evaluated and modified. This technique results in a compact document or electronic file containing all the important data in a presentable, usable, and easily understood format. 33 figs.

8446 **Spatial optic multiplexer/diplexer.** Tremblay, P.L. To Dept. of Energy. 1990. Filed date 22 Jun 1990. USA Patent patent application 7-542,215. 16p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. Order Number DE92003813. Source: OSTI; NTIS; GPO Dep.

The present invention relates generally to secure fiber optic communications and more particularly to an apparatus which effects the efficient coupling of light from multiple optic fibers into a single optic fiber. This invention is comprises of an apparatus for simultaneous transmission of optic signals having different wavelengths over a single optic fiber. Multiple light signals are transmitted through optic fibers that are formed into a circumference surrounding a central core fiber. The multiple light signals are directed by a lens into a single receiving fiber where the light combines and is then focused into the central core fiber which transmits the light to a wavelength discriminating receiver assembly. 2 figs.

8447 (WHC-EP–0372-Vol.1-Rev.1) **Hanford Environmental Information System (HEIS) user's manual: Volume 1, Revision 1.** Westinghouse Hanford Co., Richland, WA (United States). Oct 1991. 833p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. Order Number DE92003953. Source: OSTI; NTIS; INIS; GPO Dep.

The Hanford Environmental Information System (HEIS) is a consolidated set of automated resources that effectively manage the data gathered during environmental monitoring and restoration of the Hanford Site. The HEIS includes an integrated database that provides consistent and current data to all users and promotes sharing of data by the entire user community. Data stored in the HEIS are collected under several regulatory programs. Currently these include the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA); the Resource Conservation and Recovery Act of 1976 (RCRA); and the Ground-Water Environmental Surveillance Project, managed by the Pacific Northwest Laboratory. The HEIS is an information system with an inclusive database. The manual, the HEIS User's Manual, describes the facilities available to the scientist, engineer, or manager who uses the system for environmental monitoring, assessment, and restoration planning; and to the regulator who is responsible for reviewing Hanford Site operations against regulatory requirements and guidelines.

8448 (WHC-SA–1182) **Development of an administrative record system and information repository system to support environmental cleanup at the Hanford Site in Richland, Washington.** Sprouse, B.S. Westinghouse Hanford Co., Richland, WA (United States). Sep 1991. 15p. Sponsored by U.S. DOE Office of Environmental Restoration and Waste Management. DOE Contract AC06-87RL10930. (CONF-910981–32: Environmental remediation '91 conference, Pasco, WA (United States), 8-11 Sep 1991). Order Number DE92002049. Source: OSTI; NTIS; INIS; GPO Dep.

The purpose of this paper is to describe the development of an administrative record (AR) file system for the Hanford Site in Richland, Washington. This paper will focus on the background of the AR system and its implementation at the Hanford Site; the types of documents to be included in an AR file; the management system used to develop and implement the AR system; the unique characteristics of the AR system and the role of the information repositories. The objective of this session is to present the methodology used in developing an AR and information repository system so that common hurdles from various sites can be addressed and resolved similarly. Therefore unnecessary effort does not have to be put forth to resolve the same issues over and over again. The concepts described can be applied to all federal facility sites with a minimum amount of modification and revision. 9 refs.

8449 (WHC-SA–1292) **Beyond the media: A new strategy for distributing scientific and technical information.** Preecs, B.L. Westinghouse Hanford Co., Richland, WA (United States). Nov 1991. 12p. Sponsored by U.S. DOE Office of Administration and Human Resource Management. DOE Contract AC06-87RL10930. (CONF-920145–1: Making information work, Washington, DC (United States), 21-23 Jan 1992). Order Number DE92003633. Source: OSTI; NTIS; GPO Dep.

Communications media – newspapers, television, magazines, etc. – may be the most powerful single influence on modern life. Certainly they are the most important source of information citizens use to form opinions about such complex scientific questions as global warming or nuclear waste cleanup. But commercial news media have built-in limitations on their effectiveness as information sources. Reliance on advertising for revenue means the media are limited in the volume of material they can cover. In addition, the need to attract the largest possible, or the most select, audience for advertisers limits the complexity of information that the media can present. Finally, existing media organizations offer few, if any, ways for users to retrieve past information. These limitations deprive citizens of needed information, increase pressure on political leaders, and create the gridlock over scientific and public policy questions caused by the "Not in My Backyard" snydrome. Fortunately, modern communications technology is changing in ways that allow public policy makers to address these shortenings. Companies now barred from the information business are seeking to enter, existing media companies are looking for new sources of revenue, and new information products are seeking markets. Several changes to existing media and communications policy will be suggested and general principles for building a better overall communications system will be discussed. 18 refs.

9904 Law

Refer also to citation(s) 6386, 6881

8450 (IAEA-INFCIRC–397) **Note to the Director General from the Ministry of Foreign Affairs of The Russian Federation.** International Atomic Energy Agency, Vienna (Austria). 9 Jan 1992. 3p. Order Number DE92615181. Source: OSTI; NTIS (US Sales Only); INIS.

Hard copies are available in English and Russian from IAEA Division of Publications, Distribution Unit.

On 26 December 1991 the Director General received a Note from the Ministry of Foreign Affairs of The Russian Federation informing him that The Russian Federation continues the membership of the Union of Soviet Socialist Republics in the IAEA. The full text of this Note is reproduced in Attachment 1. On 24 December 1991 the Director General received a Note from the Secretary General of the United Nations transmitting a letter from the President of the Russian Federation concerning membership of The Russian Federation in the United Nations. The full text of this letter is reproduced in Attachment 2.

Corporate Author Index

This index lists the corporate authors responsible for issuing the documents in this publication which are identified primarily by report number. The corporate names are entered in standardized forms as defined in ETDE/PUB--3, *International Energy: Research Organizations 1986–1990*. Each entry under a corporate name includes the document title and citation number. Three items of information may appear in parentheses: (1) an abbreviation to identify the document type, such as a report; (2) the country of publication, also abbreviated; and (3) the language of the document if non-English (R;US;In French). Author affiliations are not listed in this index.

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	17:7162	PATENTS-US–A7506126
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	17:7172	SAND–91-2204
	17:7213	PATENTS-US–A7520475
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	17:7284	SAND–91-2587C
	17:7467	SAND–91-2451C
	17:7475	SAND–91-2705C
	17:7476	PATENTS-US–A7511372
	17:7480	PATENTS-US–A7516399
	17:7512	PATENTS-US–A7531492
	17:7514	SAND–91-2303C
	17:7515	SAND–91-2376C
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	17:7526	SAND–91-2486C
	17:7531	SAND–90-2711
	17:7533	SAND–91-2328
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	17:7862	SAND–91-2150
	17:8195	SAND–91-1508C
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	17:8374	SAND–91-1700C
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	17:8421	SAND–91-1752
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	17:6531	SAND–91-7013
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AC04-76DP03533	**EG and G Rocky Flats, Inc., Golden, CO (United States). Rocky Flats Plant**	
	17:7513	PATENTS-US–A7551834
AC04-76DR00789	**Sandia Labs., Livermore, CA (United States)**	
	17:7532	SAND–90-8248
	Sandia National Labs., Livermore, CA (United States)	
	17:6528	PATENTS-US–A7537957
	17:7059	SAND–91-8703
AC04-76EV01013	**Lovelace Biomedical and Environmental Research Inst., Albuquerque, NM (United States). Inhalation Toxicology Research Inst.**	
	17:7801	CONF-9110308–1
AC04-88DP43495	**EG and G Mound Applied Technologies, Miamisburg, OH (United States)**	
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	17:6404	MLM–3726(OP)
	17:6405	MLM–3727(OP)
	17:6406	MLM–3728(OP)
	17:6407	MLM–3729(OP)
	17:6475	MLM–3724(OP)
	17:7015	MLM–3709
	17:7016	MLM–3720(OP)
	17:7478	MLM–3714(OP)
	17:7479	MLM–3725(OP)
	Mound, Miamisburg, OH (United States)	
	17:8408	MLM–3722
	17:8445	MLM–3711
AC05-76OR00001	**Portsmouth Gaseous Diffusion Plant, OH (United States)**	
	17:7058	POEF-T–3581-Extd.Abst.
	17:7591	POEF/ER/Sub–88/4523
AC05-76OR00033	**Florida Univ., Gainesville, FL (United States)**	
	17:7575	DOE/OR/00033–T456
	Massachusetts Inst. of Tech., Cambridge, MA (United States). Dept. of Nuclear Engineering	
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	Michigan Univ., Ann Arbor, MI (United States)	
	17:7807	DOE/OR/00033–T455
	Michigan Univ., Ann Arbor, MI (United States). School of Public Health	
	17:7686	DOE/OR/00033–T453
	Oak Ridge Associated Universities, Inc., TN (United States)	
	17:8123	DOE/OR/00033–T462
	17:6803	DOE/OR/00033–T448
	Oak Ridge National Lab., TN (United States)	
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	Puerto Rico Univ., Rio Piedras (Puerto Rico)	
	17:7683	DOE/OR/00033–T459
	Tennessee Univ., Knoxville, TN (United States)	
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	17:6774	CONF-9111144–2

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	Vanderbilt Univ., Nashville, TN (United States)	
	17:6915	DOE/OR/00033–T460
	17:7576	DOE/OR/00033–T457
	Committee on Interagency Radiation Research and Policy Coordination, Washington, DC (United States)	
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	Illinois Univ., Urbana, IL (United States). Dept. of Nuclear Engineering	
	17:7415	DOE/OR/00033–T464
AC05-78OR03054	**International Coal Refining Co., Allentown, PA (United States)**	
	17:6107	DOE/OR/03054–120
AC05-84ER40150	**Southeastern Universities Research Association, Newport News, VA (United States). Continuous Electron Beam Accelerator Facility**	
	17:7967	DOE/ER/40150–178
AC05-84OR21400	**Oak Ridge National Lab., TN (United States)**	
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	17:6995	CONF-911272–1
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	17:7066	CONF-911270–1
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	17:7217	PATENTS-US–A7559030
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	17:7499	CONF-911132–8
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	17:8415	ORNL/TM–11960
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	Oak Ridge National Lab., TN (United States). Health and Safety Research Div.	
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	Martin Marietta Energy Systems, Inc., Oak Ridge, TN (United States)	
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	Nuclear Regulatory Commission, Washington, DC (United States). Div. of Regulatory Applications	
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	Oak Ridge National Lab., TN (United States). Carbon Dioxide Information Analysis Center	
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	Nuclear Regulatory Commission, Washington, DC (United States). Div. of Systems Research	
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	Oak Ridge National Lab., TN (United States). Applied Technology Div.	
	17:7018	ORNL/ATD–62
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	Kentucky Univ., Lexington, KY (United States). Center for Computational Sciences	
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AC05-84OS21400	**Oak Ridge Y-12 Plant, TN (United States)**	
	17:6468	Y/ER–19
AC05-84OT21400	**Nuclear Regulatory Commission, Washington, DC (United States). Div. of Safeguards and Transportation**	
	17:6328	NUREG/CR–5734
	Oak Ridge K-25 Site, TN (United States)	
	17:6397	K/TCD–1004
	17:8441	K/CSD/TM–93-Rev.1
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AC05-86OR21548	**MK-Ferguson Co., St. Charles, MO (United States)**	
	17:7577	DOE/OR/21548–194
	17:7615	DOE/OR/21548–224
AC06-76RL01830	**Battelle-Northwest, Richland, WA (United States). Pacific Northwest Lab.**	
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	Hanford Works, Richland, WA (United States)	
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	17:6338	HW–7-5708-Del.
	17:6339	HW–7-5821-Del.
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	17:6678	HW–7-3689
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	17:6682	HW–56230-RD
	USAEC, Washington, DC (United States)	
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	Battelle Pacific Northwest Lab., Richland, WA (United States)	
	17:6672	BNWL-CC–1055
	Westinghouse Hanford Co., Richland, WA (United States)	
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	General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation	
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	17:6342	HW–31005
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	17:6344	HW–31514
	17:6345	HW–32056
	17:6346	HW–34216
	17:6347	HW–35445
	17:6348	HW–50241
	17:6349	HW–54005
	17:6350	HW–55014-RD
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	17:6352	HW–60143
	17:6353	HW–89083
	17:6664	HW–78458
	17:6665	HW-SA–3547
	17:6683	HW–58265-RD
	17:6684	HW–60157
	17:6685	HW–62585
	17:6686	HW–66468
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	Pacific Northwest Lab., Richland, WA (United States)	
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	17:6420	PNL-SA–20045
	17:6478	PNL–7871
	17:6643	PNL-SA–18065
	17:6644	PNL-SA–20093
	17:6659	PNL-SA–19551
	17:6661	BNWL-SA–668
	17:6671	BNWL-CC–455
	17:6705	BNWL-CC–1367
	17:6791	PNL-SA–19675
	17:6844	PNL–7889
	17:6942	PNL-SA–19782
	17:6943	PNL-SA–20244
	17:6989	PNL-SA–19687
	17:7557	PNL–6450-47-HEDR
	17:7558	PNL–7781
	17:7559	PNL–7868-HEDR
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	17:7589	PNL–7927
	17:7590	PNL-SA–19779
	17:7629	PNL–7836
	17:7630	PNL–7869-HEDR
	17:7631	PNL–7876
	17:7806	PNL-SA–19355
	17:7808	PNL-SA–20116
	17:8368	PNL-SA–19346
	17:8369	PNL-SA–19386
	17:8370	PNL-SA–19387
	17:8371	PNL-SA–19571
	17:8381	PNL–7713-HEDR
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	Lawrence Livermore National Lab., CA (United States)	
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	Geological Survey, Portland, OR (United States)	
	17:6455	HAN–18510
AC06-86NE37963	**Oregon Graduate Inst. of Science and Technology, Beaverton, OR (United States)**	
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AC06-87RL10930	**Hanford Works, Richland, WA (United States)**	
	17:6687	HW–68718-Del.
	Westinghouse Hanford Co., Richland, WA (United States)	
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	17:6446	WHC-EP–0451
	17:6447	WHC-EP–0465-Vol.3-Pt.B
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	17:6466	WHC-EP–0474-1
	17:6467	WHC-EP–0474-2
	17:6497	WHC-SA–1259-Rev.1
	17:6610	WHC-SA–1402
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	17:6701	WHC-SP–0229
	17:6702	WHC-SP–0229-A
	17:6703	WHC-SP–0600-Rev.1
	17:6800	WHC-SA–1273
	17:6836	WHC-SA–1257-Rev.1
	17:7565	WHC-EP–0536
	17:7613	WHC-EP–0489
	17:8391	WHC-SA–1403
	17:8447	WHC-EP–0372-Vol.1-Rev.1
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	General Electric Co., Richland, WA (United States). Hanford Atomic Products Operation	
	17:6688	HW-SA–2016
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	United Nuclear Industries, Inc., Richland, WA (United States)	
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	Department of Energy, Richland, WA (United States). Richland Operations Office	
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	UNC Nuclear Industries, Inc., Richland, WA (United States)	
	17:6700	UNI–81-01
	USDOE Richland Operations Office, WA (United States)	
	17:6334	DOE/RL–90-24-Vol.1-Rev.1
	17:6453	DOE/RL–90-32-Rev.1
AC07-76ID01570	**Department of Energy, Idaho Falls, ID (United States). Idaho Operations Office**	
	17:6507	DOE/ID–10237(90-91)
	EG and G Idaho, Inc., Idaho Falls, ID (United States)	
	17:6384	EGG-WTD–9776-Rev.1
	17:6457	EGG-WTD–9899
	17:6545	EGG-EP–9839
	17:6606	EGG-M–91428
	17:6607	EGG-M–91485
	17:6630	EGG-M–91053
	17:6655	EGG–2663
	17:6713	EGG-M–91216
	17:6714	EGG-M–91370
	17:6715	EGG-M–91489
	17:6716	EGG-M–91501
	17:6767	EGG-EP–9766
	17:6793	EGG-M–91482
	17:6797	EGG-M–91483
	17:6860	EGG-M–91314
	17:6861	EGG-M–91315
	17:6940	PATENTS-US–A7543897
	17:7024	PATENTS-US–A7559234
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	17:7491	PATENTS-US–A7530673
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	Nuclear Regulatory Commission, Washington, DC (United States). Div. of Safety Issue Resolution	
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AC07-84ID12435	**Westinghouse Idaho Nuclear Co., Inc., Idaho Falls, ID (United States)**	
	17:7165	PATENTS-US–A7531487
	17:7166	PATENTS-US–A7534897
	17:7509	PATENTS-US–A7522877
AC07-85ID12489	**Utah Univ. Research Inst., Salt Lake City, UT (United States). Earth Science Lab.**	
	17:6541	DOE/ID/12489–116
AC07-88ID12735	**USDOE Pittsburgh Energy Technology Center, PA (United States)**	
	17:6827	CONF-9102112–Absts.
AC08-85NV10384	**Nevada Univ., Reno, NV (United States). Desert Research Inst.**	
	17:6777	DOE/NV/10384–T1
	Nevada Univ., Las Vegas, NV (United States). Desert Research Inst.	
	17:6776	DOE/NV/10384–65
AC08-88NV10617	**EG and G Energy Measurements, Inc., Los Alamos, NM (United States). Los Alamos Operations**	
	17:8145	EGG–10617-5093
	EG and G, Inc., Las Vegas, NV (United States). Remote Sensing Lab.	
	17:7578	EGG–10617-1080
	EG and G Energy Measurements, Inc., Las Vegas, NV (United States)	
	17:6783	EGG–10617-2093
	EG and G Energy Measurements, Inc., Goleta, CA (United States). Santa Barbara Operations	
	17:7643	EGG–10617-2080
	EG and G Energy Measurements, Inc., Goleta, CA (United States)	
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	EG and G Energy Measurements, Inc., Las Vegas, NV (United States). Remote Sensing Lab.	
	17:7579	EGG–10617-1132
AC08-89NV10630	**Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (United States)**	
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	Reynolds Electrical and Engineering Co., Inc., Las Vegas, NV (United States). Health Physics Dept.	
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AC08-90NV10845	**Nevada Univ., Las Vegas, NV (United States). Desert Research Inst.**	
	17:6778	DOE/NV/10845–66
	Nevada Univ., Las Vegas, NV (United States). Water Resources Center	
	17:8385	DOE/NV/10845–12
AC09-76SR00001	**Puerto Rico Univ., Rio Piedras (Puerto Rico)**	
	17:7683	DOE/OR/00033–T459
AC11-76PN00014	**Bettis Atomic Power Lab., West Mifflin, PA (United States)**	
	17:6650	PATENTS-US–A7531355
	17:7511	PATENTS-US–A7531356
AC11-89PN38014	**Bettis Atomic Power Lab., West Mifflin, PA (United States)**	
	17:7510	PATENTS-US–A7529403
AC12-76SN00052	**General Electric Co., Schenectady, NY (United States)**	
	17:6752	PATENTS-US–A7546827
	17:6753	PATENTS-US–A7549982
	17:6941	PATENTS-US–A7547370
	Knolls Atomic Power Lab., Schenectady, NY (United States)	
	17:7161	PATENTS-US–A7504152
	17:8129	KAPL–4731
AC21-85MC22012	**Fluidized-Bed Technologies, Inc., Chattanooga, TN (United States)**	
	17:6267	DOE/MC/22012–3003
AC21-86MC23165	**North Dakota Univ., Grand Forks, ND (United States). Energy and Environmental Research Center**	
	17:6255	CONF-910571–
AC21-87MC24164	**Solid State Fuel Cells, Columbia, MD (United States)**	
	17:6837	DOE/MC/24164–3012
AC21-88MC24248	**Carnegie-Mellon Univ., Pittsburgh, PA (United States). Center for Energy and Environmental Studies**	
	17:6163	DOE/MC/24248–3015
AC21-88MC25006	**Research Triangle Inst., Research Triangle Park, NC (United States)**	
	17:6164	DOE/MC/25006–3011
AC21-88MC25124	**Little (Arthur D.), Inc., Cambridge, MA (United States)**	
	17:6875	DOE/MC/25124–3014
AC21-89MC26044	**Southwest Research Inst., San Antonio, TX (United States)**	
	17:6876	DOE/MC/26044–T28
AC22-85PC81010	**General Electric Environmental Systems, Lebanon, PA (United States)**	
	17:6243	DOE/PC/81010–T1
AC22-86PC90275	**Combustion Engineering, Inc., Windsor, CT (United States)**	
	17:6281	DOE/PC/90275–T18
AC22-87PC79651	**Vortec Corp., Collegeville, PA (United States)**	
	17:6269	DOE/PC/79651–T2
AC22-87PC79672	**USDOE Pittsburgh Energy Technology Center, PA (United States)**	
	17:6832	CONF-9102112–Absts.
AC22-87PC79679	**General Sciences, Inc., Souderton, PA (United States)**	
	17:6834	DOE/PC/79679–T1
AC22-87PC79816	**Massachusetts Inst. of Tech., Cambridge, MA (United States)**	
	17:6165	DOE/PC/79816–8
AC22-87PC79850	**Arizona Univ., Tucson, AZ (United States). Dept. of Chemical Engineering**	
	17:6270	DOE/PC/79850–6
	17:6271	DOE/PC/79850–7
	17:6272	DOE/PC/79850–8
	17:6273	DOE/PC/79850–9
	17:6274	DOE/PC/79850–10
AC22-87PC90005	**Air Products and Chemicals, Inc., Allentown, PA (United States)**	
	17:6178	DOE/PC/90005–T51
	17:6179	DOE/PC/90005–T53
	17:6180	DOE/PC/90005–T54
AC22-87PC90274	**USDOE Pittsburgh Energy Technology Center, PA (United States)**	
	17:6826	CONF-9102112–Absts.
AC22-88PC88652	**Mississippi State Univ., MS (United States). Diagnostic Instrumentation and Analysis Lab.**	
	17:6835	DOE/PC/88652–T7
AC22-88PC88802	**SRI International, Menlo Park, CA (United States)**	
	17:6166	DOE/PC/88802–T7
	17:6167	DOE/PC/88802–T8
AC22-88PC88818	**Hydrocarbon Research, Inc., Princeton, NJ (United States)**	
	17:6168	DOE/PC/88818–10
AC22-88PC88850	**Radian Corp., Austin, TX (United States)**	
	17:6244	DOE/PC/88850–T5
AC22-88PC88852	**United Engineers and Constructors, Inc., Denver, CO (United States). Stearns-Roger Div.**	
	17:6245	DOE/PC/88852–T4
	17:6566	DOE/PC/88852–T3-Rev.1
AC22-88PC88868	**Southern Research Inst., Birmingham, AL (United States)**	
	17:6567	DOE/PC/88868–T6
AC22-89BC14479	**Colorado Univ., Boulder, CO (United States). Dept. of Chemical Engineering**	
	17:6317	DOE/BC/14479–7
AC22-89PC88654	**Combustion Engineering, Inc., Windsor, CT (United States)**	
	17:6275	DOE/PC/88654–T3
AC22-89PC89878	**Advanced Fuel Research, Inc., East Hartford, CT (United States)**	
	17:6176	DOE/PC/89878–T6
AC22-89PC89883	**Consolidation Coal Co., Library, PA (United States). Research and Development Dept.**	
	17:6177	DOE/PC/89883–27
AC22-90BC14202	**Oklahoma Univ., Norman, OK (United States)**	
	17:6296	DOE/BC/14202–6
AC22-90PC90044	**Lehigh Univ., Bethlehem, PA (United States). Zettlemoyer Center for Surface Studies**	
	17:6181	DOE/PC/90044–4
AC22-90PC90160	**Atlantic Research Corp., Alexandria, VA (United States)**	
	17:6559	DOE/PC/90160–T3
AC22-90PC90167	**Energy International Corp., Pittsburgh, PA (United States)**	
	17:6110	DOE/PC/90167–T3
	17:6111	DOE/PC/90167–T4
AC22-90PC90177	**Coal Technology Corp., Bristol, VA (United States)**	
	17:6118	DOE/PC/90177–T5

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AC22-90PC90178	Utah Univ., Salt Lake City, UT (United States)	
	17:6119	DOE/PC/90178–T4
AC22-91PC90185	Worcester Polytechnic Inst., MA (United States). Dept. of Mechanical Engineering	
	17:6254	CONF-9108127–3
AC22-91PC91026	Advanced Fuel Research, Inc., East Hartford, CT (United States)	
	17:6193	DOE/PC/91026–T2
AC34-90DP62349	Rockwell International Corp., Golden, CO (United States). Rocky Flats Plant	
	17:7160	PATENTS-US–A7502962
	EG and G Rocky Flats, Inc., Golden, CO (United States). Rocky Flats Plant	
	17:6365	RFP–4530
	17:6421	RFP–4479
	17:6990	RFP–4528
	17:7169	RFP–4488
	17:7170	RFP–4509
	17:7463	PATENTS-US–A7540240
	17:7464	PATENTS-US–A7560667
	17:7530	RFP–4349
AC35-89ER40486	Superconducting Super Collider Lab., Dallas, TX (United States)	
	17:7366	SSCL–340
	17:7367	SSCL–479
	17:7368	SSCL–559
	17:7369	SSCL-Preprint–6
	17:7869	SSCL-SR–1181
AI01-87ER60574	National Research Council, Washington, DC (United States). Committee on Global Change	
	17:7818	DOE/ER/60574–T1
AI06-91RL12253	Bureau of Mines, Pittsburgh, PA (United States). Pittsburgh Research Center	
	17:6378	DOE/RL/12253–T3
AI08-86NV10583	Geological Survey, Denver, CO (United States)	
	17:7809	CONF-8909163–15
	17:7810	CONF-8909163–17
	17:7811	CONF-8909163–18
	Geological Survey, Mercury, NV (United States)	
	17:7528	CONF-8909163–16
AM03-76SF00010	Stanford Linear Accelerator Center, Menlo Park, CA (United States)	
	17:7962	SLAC-PUB–5669
AS03-79EV10277	California Univ., Berkeley, CA (United States)	
	17:7802	DOE/EV/10277–T2
AS03-89ER40527	California Univ., San Diego, La Jolla, CA (United States). Dept. of Physics	
	17:7304	DOE/ER/40527–T2
AS05-80ER10578	Oak Ridge National Lab., TN (United States)	
	17:8152	CONF-9106284–2-Extd.Abst.
AS05-80ER10742	Brookhaven National Lab., Upton, NY (United States)	
	17:8180	BNL–46352
AS06-88ER40423	Washington Univ., Seattle, WA (United States). Dept. of Physics	
	17:7941	DOE/ER/40423–27
AT03-76SF70013	Argonne National Lab., IL (United States)	
	17:6336	ESG-DOE–13277
	Rockwell International Corp., Canoga Park, CA (United States). Energy Systems Group	
	17:6335	ESG-DOE–13276
AT06-82ER12027	Washington State Univ., Pullman, WA (United States). Inst. of Biological Chemistry	
	17:7647	DOE/ER/12027–6
BI79-88BP39339	Eastern Washington Univ., Cheney, WA (United States). Upper Columbia United Tribes Fisheries Center	
	17:6508	DOE/BP/39339–5
FC01-91EI22627	Massachusetts Executive Office of Consumer Affairs and Business Regulation, Boston, MA (United States). Div. of Energy Resources	
	17:6302	DOE/EI/22627–T1
FC02-90CE40938	Texas A and M Univ., College Station, TX (United States). Texas Engineering Experiment Station	
	17:6311	DOE/CE/40938–1
FC07-91ID13074	Kansas State Univ., Manhattan, KS (United States). Coll. of Engineering	
	17:6878	DOE/ID/13074–T1
FC21-86MC11076	Western Research Inst., Laramie, WY (United States)	
	17:6162	DOE/MC/11076–3017
	17:6318	DOE/MC/11076–3019
FC21-89MC25137	Colorado-Ute Electric Association, Inc., Montrose, CO (United States)	
	17:6268	DOE/MC/25137–2999
FC22-89PC88697	Pennsylvania State Univ., University Park, PA (United States). Combustion Lab.	
	17:6276	DOE/PC/88697–T4
FC22-90PC89651	Southern Co. Services, Inc., Birmingham, AL (United States)	
	17:6277	DOE/PC/89651–T2
FC22-90PC89659	Babcock and Wilcox Co., Alliance, OH (United States). Research and Development Div.	
	17:6278	DOE/PC/89659–2
FC22-91PC90544	Stone and Webster Engineering Corp., Denver, CO (United States)	
	17:6246	DOE/PC/90544–T1
FG01-89CE15348	Tennessee Technological Univ., Cookeville, TN (United States). Center for Mfg. Research and Technology Utilization	
	17:6848	DOE/CE/15348–T8
FG01-89CE15449	Instatherm Co., Cary, NC (United States)	
	17:6849	DOE/CE/15449–T8
FG01-90CE15459	S-Cal Research Corp., San Rafael, CA (United States)	
	17:6313	DOE/CE/15459–T4
FG02-84ER13204	Northwestern Univ., Evanston, IL (United States). Dept. of Biochemistry, Molecular Biology and Cell Biology	
	17:7642	DOE/ER/13204–6
FG02-84ER40153	Cincinnati Univ., OH (United States)	
	17:7875	DOE/ER/40153–8
FG02-84ER40158	Harvard Univ., Cambridge, MA (United States). Gordon McKay Lab.	
	17:7934	CONF-901145–2
	Harvard Univ., Cambridge, MA (United States). Div. of Applied Sciences	
	17:7939	DOE/ER/40158–9
FG02-84ER45095	Pennsylvania State Univ., University Park, PA (United States)	
	17:6903	DOE/ER/45095–6
FG02-84ER52111	Illinois Univ., Urbana, IL (United States). Dept. of Electrical and Computer Engineering	
	17:8327	DOE/ER/52111–3
FG02-85ER13323	Pennsylvania State Univ., University Park, PA (United States). Dept. of Chemistry	
	17:7067	DOE/ER/13323–6

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FG02-85ER45209	**Northwestern Univ., Evanston, IL (United States)**	
	17:6971	DOE/ER/45209–6
FG02-85ER45213	**Pittsburgh Univ., PA (United States). Dept. of Materials Science and Engineering**	
	17:6904	DOE/ER/45213–10
	17:6905	DOE/ER/45213–T2
FG02-85ER45220	**Northwestern Univ., Evanston, IL (United States)**	
	17:7000	DOE/ER/45220–8
FG02-85ER53198	**Wisconsin Univ., Madison, WI (United States)**	
	17:8222	DOE/ER/53198–179
	17:8223	DOE/ER/53198–183
	17:8224	DOE/ER/53198–184
	17:8225	DOE/ER/53198–185
FG02-85ER53211	**Rensselaer Polytechnic Inst., Troy, NY (United States)**	
	17:8226	DOE/ER/53211–10
FG02-85ER53212	**Wisconsin Univ., Madison, WI (United States)**	
	17:8227	DOE/ER/53212–178
FG02-86ER13463	**Brigham Young Univ., Provo, UT (United States)**	
	17:7042	DOE/ER/13463–8
FG02-86ER13491	**Kansas State Univ., Manhattan, KS (United States). J.R. MacDonald Lab.**	
	17:8143	DOE/ER/13491–508
FG02-86ER13592	**Dartmouth Coll., Hanover, NH (United States). Dept. of Chemistry**	
	17:7099	DOE/ER/13592–6
FG02-86ER25018	**Utah State Univ., Logan, UT (United States). Dept. of Mathematics and Statistics**	
	17:8395	DOE/ER/25018–4
FG02-86ER40243	**Yale Univ., New Haven, CT (United States)**	
	17:7968	DOE/ER/40243–8
FG02-86ER40246	**Lowell Univ., MA (United States). Radiation Lab.**	
	17:8057	DOE/ER/40246–6
FG02-86ER45228	**Arizona State Univ., Tempe, AZ (United States)**	
	17:6972	DOE/ER/45228–9
FG02-86ER45239	**State Univ. of New York, Stony Brook, NY (United States). Research Foundation**	
	17:6906	DOE/ER/45239–7
FG02-86ER53214	**Johns Hopkins Univ., Baltimore, MD (United States)**	
	17:8228	DOE/ER/53214–3
FG02-86ER53218	**Wisconsin Univ., Madison, WI (United States)**	
	17:8227	DOE/ER/53212–178
	17:8318	UW-CPTC–91-18
	Wisconsin Univ., Madison, WI (United States). Dept. of Electrical and Computer Engineering	
	17:8230	DOE/ER/53218–18
	Wisconsin Univ., Madison, WI (United States). Dept. of Nuclear Engineering and Engineering Physics	
	17:8229	DOE/ER/53218–17
	17:8231	DOE/ER/53218–19
FG02-86ER53222	**Columbia Univ., New York, NY (United States). Plasma Physics Lab.**	
	17:8330	DOE/ER/53222–106
FG02-86ER60437	**Chicago Univ., IL (United States)**	
	17:7633	DOE/ER/60437–6
FG02-86ER60455	**Oakland Univ., Rochester, MI (United States)**	
	17:7102	DOE/ER/60455–5
	17:7103	DOE/ER/60455–6
FG02-86NE37967	**Florida Univ., Gainesville, FL (United States)**	
	17:7149	DOE/NE/37967–T7
FG02-86NE37969	**Michigan Univ., Ann Arbor, MI (United States)**	
	17:7150	DOE/NE/37969–3
FG02-87ER13649	**Syracuse Univ., NY (United States). Dept. of Chemical Engineering and Materials Science**	
	17:7043	DOE/ER/13649–5
FG02-87ER13676	**Massachusetts Univ., Amherst, MA (United States). Dept. of Chemical Engineering**	
	17:6858	DOE/ER/13676–3
FG02-87ER13766	**Purdue Univ., Lafayette, IN (United States). Dept. of Chemistry**	
	17:7070	DOE/ER/13766–9
FG02-87ER13772	**Massachusetts Univ., Amherst, MA (United States). Dept. of Chemical Engineering**	
	17:7545	DOE/ER/13772–4
FG02-87ER13775	**State Univ. of New York, Buffalo, NY (United States)**	
	17:7071	DOE/ER/13775–4
FG02-87ER25041	**Arizona State Univ., Tempe, AZ (United States). Dept. of Computer Science**	
	17:8396	DOE/ER/25041–3
FG02-87ER45308	**Colorado School of Mines, Golden, CO (United States)**	
	17:6898	CONF-910909–13
	Colorado School of Mines, Golden, CO (United States). Center for Welding and Joining Research	
	17:6907	DOE/ER/45308–5
FG02-87ER45310	**Massachusetts Inst. of Tech., Cambridge, MA (United States). Dept. of Materials Science and Engineering**	
	17:6908	DOE/ER/45310–35
FG02-87ER60507	**Wisconsin Univ., Madison, WI (United States). Dept. of Human Oncology**	
	17:7744	CONF-901274–2
	17:7746	DOE/ER/60507–5
FG02-88ER13840	**Colorado School of Mines, Golden, CO (United States)**	
	17:7817	DOE/ER/13840–2
FG02-88ER13849	**Rochester Univ., NY (United States)**	
	17:8144	DOE/ER/13849–4
FG02-88ER13855	**State Univ. of New York, Stony Brook, NY (United States). Dept. of Chemistry**	
	17:7073	DOE/ER/13855–5
	17:7097	DOE/ER/13855–4
FG02-88ER13860	**Colorado Univ., Boulder, CO (United States)**	
	17:7100	DOE/ER/13860–4
FG02-88ER13880	**Missouri Univ., Columbia, MO (United States)**	
	17:7074	DOE/ER/13880–4
FG02-88ER13913	**Notre Dame Univ., IN (United States). Dept. of Chemical Engineering**	
	17:7179	DOE/ER/13913–4
FG02-88ER13935	**Iowa Univ., Iowa City, IA (United States). Dept. of Chemistry**	
	17:7075	DOE/ER/13935–3
FG02-88ER13964	**Pennsylvania Univ., Philadelphia, PA (United States). Dept. of Electrical Engineering**	
	17:8136	DOE/ER/13964–3
FG02-88ER40389	**Temple Univ., Philadelphia, PA (United States). Dept. of Physics**	
	17:7940	DOE/ER/40389–71

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FG02-88ER40405	Minnesota Univ., Minneapolis, MN (United States). School of Physics and Astronomy	17:8002	DOE/ER/40405–T4
		17:8003	DOE/ER/40405–T5
FG02-88ER40410	New Hampshire Univ., Durham, NH (United States)	17:8061	DOE/ER/40410–3
FG02-88ER40415	Massachusetts Univ., Amherst, MA (United States)	17:8062	DOE/ER/40415–7
FG02-88ER40448	Rensselaer Polytechnic Inst., Troy, NY (United States). Dept. of Physics	17:7906	DOE/ER/40448–4
FG02-88ER45338	Minnesota Univ., Minneapolis, MN (United States)	17:6973	DOE/ER/45338–1
FG02-88ER53264	Wisconsin Univ., Madison, WI (United States). Phaedrus Lab. for Plasma Science	17:8331	DOE/ER/53264–1
FG02-88ER53269	Illinois Univ., Urbana, IL (United States)	17:8232	DOE/ER/53269–4
FG02-88ER60639	Michigan Univ., Ann Arbor, MI (United States)	17:7648	DOE/ER/60639–4
FG02-88ER60642	Pennsylvania Univ., Philadelphia, PA (United States)	17:7501	DOE/ER/60642–4
FG02-88ER60648	Pennsylvania State Univ., University Park, PA (United States)	17:7045	DOE/ER/60648–4
FG02-88ER60656	New York Univ., NY (United States). Dept. of Cell Biology	17:7685	DOE/ER/60656–5
FG02-89ER14017	Rochester Univ., NY (United States). Dept. of Physics and Astronomy	17:8197	DOE/ER/14017–3
FG02-89ER14045	Rensselaer Polytechnic Inst., Troy, NY (United States)	17:7481	DOE/ER/14045–5
FG02-89ER14056	Michigan State Univ., East Lansing, MI (United States). Dept. of Chemistry	17:7044	DOE/ER/14056–10
FG02-89ER40496	Pennsylvania Univ., Philadelphia, PA (United States)	17:7842	DOE/ER/40496–1
FG02-89ER45409	Utah Univ., Salt Lake City, UT (United States). Dept. of Physics	17:7001	DOE/ER/45409–2
FG02-89ER53291	Wisconsin Univ., Madison, WI (United States)	17:8227	DOE/ER/53212–178
FG02-89ER60820	Michigan Univ., Ann Arbor, MI (United States)	17:7572	DOE/ER/60820–2
	Michigan Univ., Ann Arbor, MI (United States). Dept. of Civil and Environmental Engineering	17:7569	CONF-9106315–1
FG02-90ER14135	Battelle, Columbus, OH (United States)	17:6902	DOE/ER/14135–T1
FG02-90ER25084	Brookhaven National Lab., Upton, NY (United States)	17:6992	BNL–46226
FG02-90ER45424	Brookhaven National Lab., Upton, NY (United States)	17:8180	BNL–46352
FG02-90ER45437	Queens Coll., Flushing, NY (United States). Dept. of Physics	17:8160	DOE/ER/45437–1
FG02-90ER60946	Johns Hopkins Univ., Baltimore, MD (United States). Dept. of Geography and Environmental Engineering	17:7574	DOE/ER/60946–2
FG02-90ER60989	Rensselaer Polytechnic Inst., Troy, NY (United States)	17:7682	DOE/ER/60989–2
FG02-90ER61085	Michigan Univ., Ann Arbor, MI (United States)	17:7483	DOE/ER/61085–1
FG02-90ER75564	Industrial Technology Inst., Ann Arbor, MI (United States)	17:6910	DOE/ER/75564–7
FG02-91ER12107	Missouri Univ., Columbia, MO (United States)	17:6997	DOE/ER/12107–1
FG02-91ER14185	Rochester Univ., NY (United States)	17:6999	DOE/ER/14185–1
FG02-91ER40640	Notre Dame Univ., IN (United States)	17:8006	DOE/ER/40640–1
FG02-91ER40675	Michigan Univ., Ann Arbor, MI (United States)	17:7414	DOE/ER/40675–1
FG02-91ER45439	Illinois Univ., Urbana, IL (United States). Materials Research Lab.	17:6890	DOE/ER/45439–1
FG02-91ER45445	Rhode Island Univ., Kingston, RI (United States)	17:7975	DOE/ER/45445–3
FG03-86ER13502	Scripps Institution of Oceanography, La Jolla, CA (United States)	17:7820	MPL-U–17/89
FG03-86ER13514	California Univ., Irvine, CA (United States). Dept. of Chemistry	17:7069	DOE/ER/13514–T1
FG03-86ER13527	California Univ., San Diego, La Jolla, CA (United States). Dept. of Applied Mechanics and Engineering Sciences	17:7143	DOE/ER/13527–T1
FG03-86ER52134	California Univ., Los Angeles, CA (United States). Inst. of Plasma and Fusion Research	17:8375	UCLA-PPG–1380
FG03-86ER60406	California Univ., Berkeley, CA (United States)	17:7637	DOE/ER/60406–T5
FG03-86ER60429	California Univ., San Diego, La Jolla, CA (United States)	17:7745	DOE/ER/60429–T1
FG03-86SF16306	Colorado State Univ., Fort Collins, CO (United States). Solar Energy Applications Lab.	17:6536	DOE/SF/16306–31
FG03-87ER13667	California Univ., Berkeley, CA (United States). Dept. of Physics	17:7812	DOE/ER/13667–T4
FG03-87ER13673	Stanford Univ., CA (United States). Dept. of Chemical Engineering	17:6298	DOE/ER/13673–T2
FG03-87ER13727	Lawrence Berkeley Lab., CA (United States)	17:6985	LBL–29964
FG03-87ER13807	University of Southern California, Los Angeles, CA (United States). Center for Earth Sciences	17:7814	DOE/ER/13807–T1
		17:7815	DOE/ER/13807–T2
		17:7816	DOE/ER/13807–T3
FG03-87ER52143	California Univ., Santa Barbara, CA (United States). Dept. of Chemical and Nuclear Engineering	17:8328	DOE/ER/52143–T1

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FG03-87ER53256	**Applied Microwave Plasma Concepts, Inc., Carlsbad, CA (United States)**	
	17:8208	AMPC–031-046
FG03-87ER60504	**University of Southern California, Los Angeles, CA (United States). Dept. of Physics**	
	17:8140	DOE/ER/60504–T1
FG03-89ER14066	**California Univ., Los Angeles, CA (United States)**	
	17:8137	DOE/ER/14066–1
	17:8138	DOE/ER/14066–2
	17:8139	DOE/ER/14066–3
FG03-89ER45387	**Stanford Univ., CA (United States). Dept. of Materials Science and Engineering**	
	17:6909	DOE/ER/45387–T1
FG03-89ER52154	**California Univ., Berkeley, CA (United States). Berkeley Fusion Engineering**	
	17:8329	DOE/ER/52154–T4
FG03-89ER60914	**California Univ., Davis, CA (United States). Lab. for Energy-Related Health Research**	
	17:7747	DOE/ER/60914–T1
FG03-89MI10150	**Pennsylvania Univ., Philadelphia, PA (United States)**	
	17:6775	DOE/MI/10150–T1
FG03-90ER14117	**University of Southern California, Los Angeles, CA (United States). Dept. of Chemistry**	
	17:7077	DOE/ER/14117–T1
	17:7078	DOE/ER/14117–T2
FG03-90ER14154	**Stanford Univ., CA (United States). School of Earth Sciences**	
	17:6542	DOE/ER/14154–T1
FG03-90ER60925	**California Univ., Davis, CA (United States)**	
	17:7482	DOE/ER/60925–T1
FG03-91ER61171	**California Univ., San Diego, CA (United States)**	
	17:7748	DOE/ER/61171–T1
FG04-88ER40403	**New Mexico State Univ., Las Cruces, NM (United States)**	
	17:8060	DOE/ER/40403–T3
FG05-80ET53088	**Texas Univ., Austin, TX (United States). Inst. for Fusion Studies**	
	17:8233	DOE/ET/53088–519
	17:8234	DOE/ET/53088–524
	17:8235	DOE/ET/53088–525
	17:8236	DOE/ET/53088–526
	17:8237	DOE/ET/53088–527
	17:8238	DOE/ET/53088–531
FG05-86ER13482	**North Carolina State Univ., Raleigh, NC (United States). Dept. of Mechanical and Aerospace Engineering**	
	17:6998	DOE/ER/13482–6
FG05-86ER13507	**Texas Univ., Austin, TX (United States). Dept. of Chemical Engineering**	
	17:7068	DOE/ER/13507–7
FG05-87ER40330	**Georgia Inst. of Tech., Atlanta, GA (United States). School of Physics**	
	17:8001	DOE/ER/40330–50
FG05-87ER40343	**Texas Univ., Austin, TX (United States). Dept. of Physics**	
	17:8058	DOE/ER/40343–5
FG05-87ER40353	**Tennessee Technological Univ., Cookeville, TN (United States). Dept. of Physics**	
	17:8059	DOE/ER/40353–9
FG05-88ER25063	**Virginia Univ., Charlottesville, VA (United States). Dept. of Computer Science**	
	17:8440	DOE/ER/25063–T11
FG05-88ER40444	**Texas Univ., Austin, TX (United States). Dept. of Physics**	
	17:7942	DOE/ER/40444–4-Add.
FG05-88ER40454	**Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (United States). Dept. of Physics**	
	17:8063	DOE/ER/40454–T1
FG05-88ER53266	**Texas Univ., Austin, TX (United States). Inst. for Fusion Studies**	
	17:8236	DOE/ET/53088–526
FG05-90ER14100	**Alabama Univ., University, AL (United States). Dept. of Mathematics**	
	17:8157	DOE/ER/14100–1
FG05-91ER12115	**Texas Univ., Austin, TX (United States)**	
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FG05-91ER40633	**Texas A and M Univ., College Station, TX (United States). Dept. of Physics**	
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FG06-86ER45275	**Oregon Univ., Eugene, OR (United States)**	
	17:8159	DOE/ER/45275–5
FG06-86ER60409	**Washington Univ., Seattle, WA (United States). Dept. of Biological Structure**	
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FG06-87ER13796	**Washington State Univ., Pullman, WA (United States). Dept. of Geology**	
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FG06-87ER13809	**Washington State Univ., Pullman, WA (United States)**	
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FG06-88ER25061	**Washington Univ., Seattle, WA (United States). Dept. of Applied Mathematics**	
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FG06-88ER40402	**Oregon State Univ., Corvallis, OR (United States)**	
	17:7133	DOE/ER/40402–4
FG06-88ER40427	**Washington Univ., Seattle, WA (United States)**	
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	Washington Univ., Seattle, WA (United States). Dept. of Physics	
	17:7905	DOE/ER/40427-30-N91
	Washington Univ., Seattle, WA (United States). Inst. for Nuclear Theory	
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FG06-89ER60845	**Oregon Graduate Inst. of Science and Technology, Beaverton, OR (United States). Dept. of Environmental Science and Engineering**	
	17:7573	DOE/ER/60845–2
FG06-89ER75522	**Pacific Northwest Lab., Richland, WA (United States)**	
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FG06-90ER40561	**Bern Univ. (Switzerland). Inst. fuer Theoretische Physik**	
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	17:7974	DOE/ER/40561–30
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FG06-91ER40614	**Washington Univ., Seattle, WA (United States). Dept. of Physics**	
	17:7916	DOE/ER/40614–10
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FG07-88ER12809	**Michigan Univ., Ann Arbor, MI (United States). Dept. of Nuclear Engineering**	
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FG07-88ER12812	**Purdue Univ., Lafayette, IN (United States). School of Nuclear Engineering**	
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FG07-88ER12822	**Massachusetts Inst. of Tech., Cambridge, MA (United States). Dept. of Mechanical Engineering**	
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FG07-89ER12888	**Massachusetts Inst. of Tech., Cambridge, MA (United States). Dept. of Nuclear Engineering**	
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FG07-89ER12889	**Pennsylvania State Univ., University Park, PA (United States)**	
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FG08-88ER13945	**Nevada Univ., Reno, NV (United States)**	
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FG22-86PC90504	**USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div.**	
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FG22-86PC90523	**Oklahoma State Univ., Stillwater, OK (United States). School of Chemical Engineering**	
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FG22-87PC79861	**Electric Power Research Inst., Palo Alto, CA (United States)**	
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FG22-87PC79865	**Alberta Research Council, Devon, AB (Canada). Coal and Hydrocarbon Processing Dept.**	
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FG22-87PC79925	**Lehigh Univ., Bethlehem, PA (United States). Dept. of Chemistry**	
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FG22-87PC79929	**Brown Univ., Providence, RI (United States). Div. of Engineering**	
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FG22-88PC88924	**Western Kentucky Univ., Bowling Green, KY (United States). Center for Coal Science**	
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FG22-88PC88925	**Grambling State Univ., LA (United States). Dept. of Chemistry**	
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FG22-88PC88927	**Massachusetts Inst. of Tech., Cambridge, MA (United States). Dept. of Chemical Engineering**	
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FG22-88PC88931	USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div.	17:6203	CONF-9106303–
FG22-88PC88932	USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div.	17:6235	CONF-9106303–
FG22-88PC88933	USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div.	17:6144	CONF-9106303–
FG22-88PC88934	USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div.	17:6102	CONF-9106303–
FG22-88PC88935	Pennsylvania State Univ., University Park, PA (United States)	17:6170	DOE/PC/88935–T9
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FG22-88PC88936	USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div.	17:7641	CONF-9106303–
FG22-88PC88939	Utah Univ., Salt Lake City, UT (United States). Dept. of Mining Engineering	17:6226	DOE/PC/88939–14
	USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div.	17:6206	CONF-9106303–
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FG22-88PC88942	USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div.	17:6146	CONF-9106303–
FG22-89BC14246	Oklahoma Univ., Norman, OK (United States)	17:6297	DOE/BC/14246–T10
FG22-89PC89764	USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div.	17:6207	CONF-9106303–
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FG22-89PC89769	USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div.	17:6260	CONF-9106303–
FG22-89PC89770	Purdue Univ., Lafayette, IN (United States). Dept. of Chemistry	17:6171	DOE/PC/89770–T3
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FG22-89PC89774	USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div.	17:6264	CONF-9106303–
FG22-89PC89775	Massachusetts Inst. of Tech., Cambridge, MA (United States)	17:6172	DOE/PC/89775–6
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FG22-89PC89776	Northeastern Univ., Boston, MA (United States). Dept. of Chemical Engineering	17:6279	DOE/PC/89776–T5
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FG22-89PC89785 Lehigh Univ., Bethlehem, PA (United States). Dept. of Chemistry
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FG22-89PC89787 Texas A and M Univ., College Station, TX (United States). Dept. of Chemical Engineering
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FG22-89PC89790 Washington Univ., Seattle, WA (United States). Dept. of Chemical Engineering
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FG22-89PC89791 USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div.
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FG22-90PC90176 Illinois State Univ., Normal, IL (United States). Dept. of Biological Sciences
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Illinois Univ., Urbana, IL (United States)
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Institute of Gas Technology, Chicago, IL (United States)
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Illinois State Geological Survey, Urbana, IL (United States)
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Eastern Illinois Univ., Charleston, IL (United States)
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Southern Illinois Univ., Carbondale, IL (United States). Dept. of Geology
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Purdue Univ., Lafayette, IN (United States). Lab. of Renewable Resources Engineering
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Illinois Dept. of Energy and Natural Resources, Springfield, IL (United States)
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FG22-90PC90285 USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div.
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FG22-90PC90294	**USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div.**	
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FG22-90PC90298	**USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div.**	
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FG22-90PC90301	**USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div.**	
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FG22-90PC90302	**USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div.**	
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FG22-90PC90303	**USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div.**	
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FG22-90PC90305	**USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div.**	
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FG22-90PC90306	**USDOE Pittsburgh Energy Technology Center, PA (United States). Advanced Power Generation and Fundamental Research Div.**	
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00423	17:8054	OSTI; NTIS (US Sales Only); INIS		DE92614378	
00425	17:8209	OSTI; NTIS (US Sales Only); INIS		DE92614432	
00426	17:6325	OSTI; NTIS (US Sales Only); INIS		DE92613388	
00428	17:7406	OSTI; NTIS (US Sales Only); INIS		DE92613846	
00429	17:7741	OSTI; NTIS (US Sales Only); INIS		DE92613545	
00430	17:6326	OSTI; NTIS (US Sales Only); INIS		DE92613389	
00432	17:7132	OSTI; NTIS (US Sales Only); INIS		DE92613346	
00433	17:7742	OSTI; NTIS (US Sales Only); INIS		DE92613546	
00434	17:8196	OSTI; NTIS (US Sales Only); INIS		DE92614569	
00436	17:7038	OSTI; NTIS (US Sales Only); INIS		DE92613305	
00437	17:7688	OSTI; NTIS (US Sales Only); INIS		DE92613564	
00440	17:7743	OSTI; NTIS (US Sales Only); INIS		DE92613547	
00442	17:7039	OSTI; NTIS (US Sales Only); INIS		DE92613306	
00449	17:6320	OSTI; NTIS (US Sales Only); INIS		DE92614880	
00452	17:7040	OSTI; NTIS (US Sales Only); INIS		DE92613307	
CONF-601201–		(Aerosol problems of nuclear reactors: chemical engineering aspects; Harwell (United Kingdom); 7-8 Dec 1960)			
1	17:6688	*See* HW-SA–2016			
CONF-8703340–		(National symposium on application of radioisotope techniques in industry, medicine and environment protection; Warsaw (Poland); 31 Mar - 3 apr 1987)			
	17:6485	*See* INCT–2070-2073/IChTJ/D/A,B-V.1,2			
	17:6488	*See* INCT–2070-2073/IChTJ/D/A,B-V.1,2			
CONF-8709513–		(Colloquium of the Brazilian Society of Electron Microscopy; Caxambu (Brazil); 11 Sep 1987)			
	17:6920	*See* INIS-BR–2879			
CONF-8802133–		(Workshop on quantitative dynamic stratigraphy; Sedalia, CO (United States); 14-18 Feb 1988)			
Summ.	17:7817	*See* DOE/ER/13840–2			
CONF-881150–		(IAEA seminar for Asia and the Pacific on nuclear techniques in communicable and parasitic infections; Bombay (India); 21-25 Nov 1988)			
	17:7649	*See* IAEA-TECDOC–613			
CONF-890786–		(US particle accelerator school; Upton, NY (United States); 24 Jul - 4 aug 1989)			
4	17:7285	*See* SLAC-PUB–5294			
CONF-8908129–		(12. workshop on nuclear physics; Iguazu Falls (Argentina); 28 Aug - 1 sep 1989)			
6	17:7999	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004220	MF-413
CONF-8908289–		(The physics of particle accelerator school; Brookhaven, IL (United States); Aug 1989)			
1	17:7369	*See* SSCL-Preprint–6			
CONF-890872–		(Workshop on physics at Fermilab in the 1990's; Breckenridge, CO (United States); 15-24 Aug 1989)			
16	17:8198	*See* FNAL-TM–1757			
CONF-8909163–		(5. symposium on containment of underground nuclear explosions; Santa Barbara, CA (United States); 19-21 Sep 1989)			
15	17:7809	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004281	MF-903
16	17:7528	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004280	MF-903
17	17:7810	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004279	MF-903
18	17:7811	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004278	MF-903
CONF-8909464–		(12. Brazilian congress of applied computational mathematics; Sao Jose do Rio Preto (Brazil); 4-8 Sep 1989)			
	17:6631	*See* INIS-BR–2880			
	17:8401	*See* INIS-BR–2881			
CONF-8911255–		(3. workshop on combustion and propulsion; Lorena (Brazil); 28-30 Nov 1989)			
	17:7193	*See* INIS-BR–2887			
CONF-900168–		(JAERI free electron symposium; Tokyo (Japan); 29-30 Jan 1990)			
	17:7327	*See* JAERI-M–91-141			
CONF-9002204–		(Workshop on mesons and mesonic states up to slightly above 1 GeV/c^2; Juelich (Germany); 19-20 Feb 1990)			
	17:7993	*See* Juel–2469			

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
CONF-900368–		(International congress on optical science and engineering; The Hague (Netherlands); 12-16 Mar 1990)			
12	17:7201	*See* ENEA-RT-INN–90-17			
CONF-9004179–		(Cray users group conference; Toronto (Canada); Apr 1990)			
2	17:8435	*See* UCRL-JC–104491			
CONF-9005257–		(International school on nuclear physics; Kiev (USSR); 28 May - 8 jun 1990)			
	17:7755	*See* EUR-ICP-CEH–093(S)			
CONF-9005399–		(1990 ABAQUS; New Port, RI (United States); 30 May 1990)			
1	17:8337	*See* ENEA-RT-NUCL–90-41			
CONF-9005400–		(International Atomic Energy Agency (IAEA) conference; Alushta (USSR); 22-25 May 1990)			
1	17:6643	*See* PNL-SA–18065			
CONF-900602–		(17. European Physical Society (EPS) conference on controlled fusion and plasma heating; Amsterdam (Netherlands); 25-29 Jun 1990)			
	17:8239	*See* ENEA-RT-NUCL–90-04			
CONF-9006267–		(1990 DPF summer study on high energy physics; Snowmass, CO (United States); 25 Jun - 13 jul 1990)			
36	17:7941	*See* DOE/ER/40423–27			
CONF-9006328–		(Asilomar conference on circuits, systems, and computers; Pacific Grove, CA (United States); 5-8 Jun 1990)			
2	17:8434	*See* UCRL-JC–104008			
CONF-9007106–		(31. Institute of Nuclear Materials Management (INMM) conference; Los Angeles, CA (United States); 15-18 Jul 1990)			
86	17:6480	*See* UCRL-JC–104494			
CONF-9007206–		(7. International School of Intermediate Energy Nuclear Physics; L'Aquila (Italy); 16-26 Jul 1990)			
	17:7960	*See* LYCEN–91-06			
CONF-900725–		(43. annual summer symposium on analytical chemistry; Oak Ridge, TN (United States); 24-27 Jul 1990)			
Absts.	17:7055	*See* ORNL/M–1223			
CONF-900822–		(25. IUPAP international conference on high energy physics; Singapore (Singapore); 2-8 Aug 1990)			
33	17:7933	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004290	MF-414
CONF-9009166–		(12. international free electron laser conference (FEL-12); Paris (France); 17-21 Sep 1990)			
Exc.	17:7208	*See* ENEA-RT-INN–90-59			
CONF-9009424–		(Workshop on molecular science research center: environmental materials and interfaces; Richland, WA (United States); 10-12 Sep 1990)			
	17:6791	*See* PNL-SA–19675			
CONF-9009458–		(1990 applied superconductivity conference; Snowmass Village, CO (United States); 24 Sep 1990)			
1	17:6975	*See* ENEA-RT-NUCL–90-47			
2	17:7002	*See* ENEA-RT-NUCL–90-46			
CONF-9009462–		(4. intensive seminar on 'tree rings'; Tomakomai (Japan); 3-5 Sep 1990)			
	17:7736	*See* KURRI-TR–352			
CONF-901025–		(13. international conference on plasma physics and controlled nuclear fusion research; Washington, DC (United States); 1-6 Oct 1990)			
48	17:8256	*See* ENEA-RT-NUCL–90-40			
CONF-9010278–		(6. international school on neutron physics; Alushta (USSR); 8-18 Oct 1990)			
2	17:7975	*See* DOE/ER/45445–3			

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
CONF-9010386–		(12. Brazilian Congress on Biomedical Engineering and 5. Latin American Conference on Medical Physics; Ribeirao Preto (Brazil); 7-11 Oct 1990)			
	17:7668	*See* INIS-BR–2883			
CONF-9010449–		(Workshop on reducing carbon emissions from the developing world: assessment of benefits, costs and barriers; Berkeley, CA (United States); 4-6 Oct 1990)			
Summ.	17:7819	*See* LBL–30850			
CONF-9011184–		(1990 international symposium on heavy ion fusion; Monterey, CA (United States); 6-9 Nov 1990)			
2	17:8338	*See* ENEA-RT-NUCL–90-44			
CONF-9011256–		(4. Journees des theoriciens Saturne on Dilepton production in nucleon-nucleon and nucleon-nucleus collisions at relativistic energies; Saclay (France); 22-23 Nov 1990)			
	17:7465	*See* PCCF-RI–90-16			
CONF-9011260–		(Specialists' meeting on radioactive wastes management; Kumatori (Japan); 13-14 Nov 1990)			
	17:6399	*See* KURRI-TR–349			
CONF-901145–		(Beyond the standard model II - a critical review of the standard model and the prospects for discovering new physics; Norman, OK (United States); 1-3 Nov 1990)			
2	17:7934	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004414	MF-414
CONF-9012124–		(Workshop on jet studies at LEP and HERA; Durham (United Kingdom); 8 Dec 1990)			
1	17:7943	*See* DOE/ER/40614–2			
CONF-9012128–		(Workshop 'superstrings and conformal field theories'; Tsukuba (Japan); 18-21 Dec 1990)			
	17:7893	*See* KEK-PROC–91-6			
CONF-901274–		(International symposium on radiation carcinogenesis in the whole-body system; Tokyo (Japan); 5-6 Dec 1990)			
2	17:7744	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004031	MF-408
CONF-901293–		(International conference on lasers '90; San Diego, CA (United States); 3-7 Dec 1990)			
2	17:7202	*See* ENEA-RT-INN–90-36			
CONF-9101125–		(3. symposium for global change studies; Atlanta, GA (United States); 5-10 Jan 1991)			
1	17:7823	*See* UCRL-JC–108853			
CONF-9101128–		(13. Brazilian Congress on Entomology; Recife (Brazil); 20-25 Jan 1991)			
	17:7702	*See* INIS-BR–2877(V.1)			
	17:7710	*See* INIS-BR–2877(V.2)			
CONF-9101129–		(6. workshop on radiation detectors and their uses; Tsukuba (Japan); 29-30 Jan 1991)			
	17:7446	*See* KEK-PROC–91-5			
CONF-9102132–		(International symposium on radiochemistry and radiation chemistry - plutonium 50; Bombay (India); 4-7 Feb 1991)			
	17:7134	*See* INIS-mf–13025			
CONF-9102142–		(Defending America in the 1990s; Washington, DC (United States); 20-21 Feb 1991)			
1	17:6888	*See* UCRL-JC–106720			
CONF-910287–		(National research and development conference on the control of hazardous materials; Anaheim, CA (United States); 20-22 Feb 1991)			
7	17:6852	OSTI; Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616		TI92002571	
CONF-9103112–		(Conference on fermiology of high T_c superconductors; Argonne, IL (United States); 25-27 Mar 1991)			
	17:8174	*See* ECN-RX–91-059			
CONF-9103119–		(Moriond meeting on high energy hadronic interactions; Les Arcs (France); 17-23 Mar 1991)			
4	17:8056	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004289	MF-414

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
CONF-9103130–		(North Atlantic Treaty Organization (NATO) advanced research workshop on measurement of residual stress and applied stress using neutron diffraction; Oxford (United Kingdom); 18-22 Mar 1991)			
5	17:7189	*See* ANL/CP–74775			
CONF-9103176–		(Workshop on future directions in nuclear physics with 4π gamma detection systems of the new generation; Strasbourg (France); 4-16 Mar 1991)			
4	17:8000	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004221	MF-413
CONF-9103213–		(The Minerals, Metals, and Materials Society (TMS) annual meeting; San Diego, CA (United States); 1-5 Mar 1991)			
1	17:6860	*See* EGG-M–91314			
CONF-910340–		(3. annual international industrialization symposium on the super collider (IISSC); Atlanta, GA (United States); 13-15 Mar 1991)			
51	17:7312	*See* FNAL-TM–1726			
52	17:7313	*See* FNAL-TM–1728			
CONF-910405–		(World Coal Institute conference and exhibition on coal in the environment; London (United Kingdom); 3-5 Apr 1991)			
2	17:7564	*See* UCRL-JC–108318			
CONF-910406–		(Spring meeting of the Materials Research Society (MRS); Anaheim, CA (United States); 29 Apr - 3 may 1991)			
38	17:6985	*See* LBL–29964			
39	17:6938	*See* LBL–30729			
CONF-9104106–		(53. annual American power conference; Chicago, IL (United States); 29 Apr - 1 may 1991)			
7	17:6805	*See* ANL/CP–74782			
CONF-9104321–		(7. IEEE international conference on data engineering; Kobe (Japan); 8-12 Apr 1991)			
1	17:8443	*See* LBL–30104			
CONF-9104326–		(The NACE annual conference and corrosion; Nashville, TN (United States); 27 Apr - 1 may 1991)			
1	17:6451	*See* WHC-SA–1391			
CONF-910505–		(1991 Institute of Electrical and Electronics Engineers (IEEE) particle accelerator conference (PAC); San Francisco, CA (United States); 6-11 May 1991)			
428	17:7417	*See* FNAL/C–91/205			
429	17:7305	*See* FNAL/C–91/204			
CONF-910508–		(Joint international symposium on the environmental consequences of different waste disposal; Stockholm (Sweden); 27-31 May 1991)			
2	17:7580	*See* ETDE-IT–91-83			
CONF-9105106–		(Conference on the intersections between particle and nuclear physics; Tucson, AZ (United States); 23-29 May 1991)			
34	17:7935	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004381	MF-414
35	17:7408	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004380	MF-414
CONF-9105177–		(1. international A.D. Sakharov conference on physics; Moscow (USSR); 27-31 May 1991)			
	17:7937	*See* DESY–91-080			
CONF-9105263–		(5. Pisa meeting on advanced detectors; Isola d'Elba (Italy); 26-31 May 1991)			
	17:7458	*See* NIKHEF-H–91-21			
CONF-9105275–		(Micro-macro studies of multiphase media; Argonne, IL (United States); 9-11 May 1991)			
1	17:8136	*See* DOE/ER/13964–3			
CONF-9105285–		(CHI '92; Monterey, CA (United States); 3-7 May 1991)			
2	17:8437	*See* UCRL-JC–108648			
CONF-9105291–		(Exotic neutron-rich nuclei; Darmstadt (Germany); 5-7 May 1991)			
1	17:8041	*See* LA-UR–91-3719			

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CONF-9105293–		(International symposium on capillary chromatography; Riva del Garda (Italy); 13-16 May 1991)			
1	17:7044	*See* DOE/ER/14056–10			
CONF-9105295–		(Philsosphenweg 12; Heidelberg (Germany); 7-9 May 1991)			
1	17:7357	*See* LA-UR–91-3908			
CONF-9106120–		(Recent advances on mechanics of structure continua American Society of Mechanical Engineers (ASME) applied mechanics conference; Columbus, OH (United States); 16-19 Jun 1991)			
2	17:6300	*See* UCRL-JC–106751			
CONF-9106122–		(7. international conference on real time computer applications in nuclear, particle and plasma physics; Juelich (Germany); 18-28 Jun 1991)			
	17:8444	*See* LRP–430/91			
CONF-9106180–		(NATO Advanced Study Institute conference; Acquafredda di Maratea (Italy); 11-21 Jun 1991)			
2	17:6895	*See* ANL/CP–74837			
CONF-9106196–		(Nuclear shapes and nuclear structure at low excitation energies; Cargese (France); 3-7 Jun 1991)			
4	17:8040	*See* LA-UR–91-3497			
CONF-9106222–		(Workshop on physics of compressible, turbulent mixing; Royaumont (France); 17-19 Jun 1991)			
10	17:8172	*See* UCRL-JC–10872			
11	17:8173	*See* UCRL-JC–107425			
CONF-9106224–		(1991 superconducting quantum interference devices (IC SQUID) meeting; Berlin (Germany); 18-21 Jun 1991)			
2	17:8205	*See* LBL–31157			
CONF-910626–		(6. international conference on emerging nuclear energy systems; Monterey, CA (United States); 16-21 Jun 1991)			
14	17:6699	*See* UCRL-JC–107357			
CONF-9106274–		(Symposium on high energy nuclear collisions and quark gluon plasma; Kyoto (Japan); 6-8 Jun 1991)			
5	17:7908	*See* DOE/ER/40561–22			
CONF-9106276–		(Charged particle beam conference; Silver Springs, MD (United States); 25-27 Jun 1991)			
4	17:7284	*See* SAND–91-2587C			
CONF-9106284–		(10. international conference on laser spectroscopy; Font-Romeu (France); 17-21 Jun 1991)			
2-Extd.Abst.	17:8152	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005166	MF-411
CONF-9106289–		(3. topical seminar on heavy flavors; S. Miniato (Italy); Jun 1991)			
4	17:7946	*See* FNAL/C–91/328			
CONF-9106305–		(18. world gas conference; Berlin (Germany); 24-28 Jun 1991)			
1	17:6160	OSTI; Institute of Gas Technology, 3424 South State Street, Chicago, IL 60616		TI92002569	
CONF-9106315–		(65. annual colloid and surface science symposium; Norman, OK (United States); 17-19 Jun 1991)			
1	17:7569	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004336	MF-403
CONF-910662–		(12. international conference on magnet technology; Leningrad (USSR); 23-28 Jun 1991)			
13-Rev.	17:7359	*See* LBL–29973-Rev.			
14	17:7309	*See* FNAL/C–91/255			
15	17:7310	*See* FNAL/C–91/257			
16	17:7308	*See* FNAL/C–91/254			
CONF-9107104–		(5. international conference on precipitation scavenging and atmosphere surface exchange process; Richland, WA (United States); 15-19 Jul 1991)			
18	17:7542	*See* ANL/CP–71762			

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19-Rev.1	17:7561	*See* UCRL-JC–106109-Rev.1			
2-Rev.1	17:7562	*See* UCRL-JC–106966-Rev.1			
CONF-9107115–		(Society of Photo-Optical Instrumentation Engineers (SPIE) meeting; San Diego, CA (United States); 21-26 Jul 1991)			
60	17:7235	*See* UCRL-JC–108670			
61	17:7496	*See* UCRL-JC–107983			
62	17:7234	*See* UCRL-JC–107982			
CONF-9107127–		(Conference on scanning microscopy instrumentation; San Diego, CA (United States); 21-26 Jul 1991)			
1	17:7283	*See* LBL–31242			
CONF-910717–		(2. international laser conference: material engineering, medicine, biology, physics and chemistry; Grenoble (France); 9-11 Jul 1991)			
1	17:7233	*See* UCRL-JC–107363			
CONF-9107172–		(15. joint international lepton photon symposium at high energies and European Physical Society (EPS) conference on high energy; Geneva (Switzerland); 25 Jul - 1 aug 1991)			
	17:7928	*See* NIKHEF-H–91-24			
5	17:7963	*See* ANL-HEP-CP–91-88			
8	17:7945	*See* FNAL/C–91/287-E			
9	17:7976	*See* FNAL/C–91/294-E			
10	17:8065	*See* FNAL/C–91/325			
CONF-9107193–		(Center for Waste Reduction Technologies (CWRT) workshop on waste reduction R&D opportunities in industry; Arlington, VA (United States); 24 Jul 1991)			
Summ.	17:6855	*See* DOE/CE–40762T-H4			
CONF-9107194–		(NIRS international workshop on heavy charged particle therapy and related subjects; Chiba (Japan); 4-5 Jul 1991)			
1	17:7786	*See* LBL–31422			
CONF-9107195–		(Trieste summer school; Trieste (Italy); 22-25 Jul 1991)			
1	17:7860	*See* LA-UR–91-4101			
CONF-9107196–		(Positron satellite meeting of ICPEAC; Sydney (Australia); 3-5 Jul 1991)			
1	17:7838	*See* BNL–46868			
CONF-9107201–		(10. IAMP congress on mathematical physics; Leipzig (Germany); 30 Jul - 9 aug 1991)			
	17:7873	*See* DESY–91-113			
CONF-910728–		(32. US symposium on rock mechanics; Norman, OK (United States); 10-12 Jul 1991)			
8	17:6430	*See* SAND–91-0269			
CONF-910730–		(4. international conference on synchrotron radiation instrumentation; Chester (United Kingdom); 15-19 Jul 1991)			
24	17:7289	*See* ANL/CP–72872			
25	17:7505	*See* LBL–30456			
26	17:8183	*See* BNL–46822			
27	17:7372	*See* BNL–46810			
28	17:8135	*See* BNL–46809			
CONF-910803–		(International congress on refrigeration: new challenges in refrigeration; Montreal (Canada); 10-17 Aug 1991)			
6	17:7306	*See* FNAL/C–91/218			
CONF-910806–		(5. international symposium on environmental degradation on materials in nuclear power systems - water reactors; Monterey, CA (United States); 25-29 Aug 1991)			
7	17:6638	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004443	
CONF-910809–		(International symposium on energy and environment; Espoo (Finland); 25-28 Aug 1991)			
2-Rev.1	17:7563	*See* UCRL-JC–108038-Rev.1			
CONF-910810–		(7. international symposium on high voltage engineering (ISH-7); Dresden (Germany); 26-30 Aug 1991)			
6	17:7865	*See* UCRL-JC–109165			

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CONF-9108100–		(American Statistical Association (ASA) annual meeting; Atlanta, GA (United States); 18-22 Aug 1991)			
7	17:7155	*See* KCP–613-4643			
CONF-9108105–		(8. topical conference on atomic processes in plasmas; Portland, ME (United States); 25-29 Aug 1991)			
4	17:8317	*See* UCRL-JC–107675			
5	17:8153	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004228	MF-411
CONF-9108118–		(13. international free-electron laser (FEL) conference; Santa Fe, NM (United States); 25-30 Aug 1991)			
33	17:7360	*See* LBL–30672			
34	17:7282	*See* LBL–30674			
35	17:7296	*See* BNL–46165			
37	17:7371	*See* BNL–46799			
38	17:7297	*See* BNL–46679			
39	17:7300	*See* BNL–46794			
40	17:7301	*See* BNL–46795			
CONF-9108127–		(2. U.S.-Japan seminar on micromechanics of granular materials; Syracuse, NY (United States); 4-10 Aug 1991)			
3	17:6254	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004496	MF-117
CONF-9108140–		(Phenomenology and applications of high temperature superconductivity; Los Alamos, NM (United States); 22-24 Aug 1991)			
2	17:6962	*See* ANL/CP–74692			
CONF-9108150–		(9. international conference on positron annihilation; Szombathely (Hungary); 26-31 Aug 1991)			
3	17:8382	*See* BNL–46856			
CONF-9108153–		(1991 scanning tunneling microscopy; Interlaken (Switzerland); 12-16 Aug 1991)			
2	17:7506	*See* LBL–31121			
CONF-910817–		(11. international conference on structural mechanics in reactor technology; Tokyo (Japan); 18-23 Aug 1991)			
	17:6383	*See* ECN-RX–91-017			
CONF-9108183–		(PILAC optics workshop; Los Alamos, NM (United States); 12-13 Aug 1991)			
	17:7253	*See* LA-UR–91-3436			
CONF-9108184–		(Adriatico conference on strongly correlated electrons; Trieste (Italy); Aug 1991)			
1	17:8204	*See* LA-UR–91-3717			
CONF-9108185–		(Workshop on superstrings and related topics; Trieste (Italy); Aug 1991)			
1	17:7894	*See* LBL–31325			
CONF-9108186–		(Relativistic aspects of nuclear physics; Rio de Janeiro (Brazil); 2-30 Aug 1991)			
1	17:7905	*See* DOE/ER/40427–30-N91			
CONF-910819–		(4. international conference on processing and utilization of high sulfur coals; Idaho Falls, ID (United States); 26-30 Aug 1991)			
2	17:6282	*See* ANL/CP–72016			
CONF-910862–		(Pacific-international congress on x-ray analytical methods; Honolulu, HI (United States); 12-16 Aug 1991)			
7	17:7543	*See* BNL–46337			
CONF-910864–		(4. international conference on hadron spectroscopy; College Park, MD (United States); 12-16 Aug 1991)			
7	17:7962	*See* SLAC-PUB–5669			
8	17:7994	*See* SLAC-PUB–5682			
CONF-910870–		(49. Electron Microscopy Society of America (EMSA) annual meeting; San Jose, CA (United States); 4-9 Aug 1991)			
24	17:6937	*See* LBL–30693			
25	17:8376	*See* UCRL-JC–106873			
CONF-910881–		(Particles and fields '91; Vancouver (Canada); 18-22 Aug 1991)			
28	17:7916	*See* DOE/ER/40614–10			

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29	17:7307	*See* FNAL/C–91/246			
6-Rev.	17:7468	*See* SLAC-PUB–5642-Rev.			
CONF-910898–		(Hot summer daze: quantum chromodynamics at finite temperature and density; Upton, NY (United States); 6-17 Aug 1991)			
1	17:7914	*See* DOE/ER/40561–32			
CONF-910901–		(4. international conference on facility operations/safeguards interface; Albuquerque, NM (United States); 29 Sep - 4 oct 1991)			
24	17:6475	*See* MLM–3724(OP)			
25	17:7479	*See* MLM–3725(OP)			
26	17:7478	*See* MLM–3714(OP)			
CONF-910903–		(International conference on magnetism; Edinburgh (United Kingdom); 1-7 Sep 1991)			
12	17:8181	*See* BNL–46717			
CONF-910908–		(2. conference of the European Ceramic Society; Augsburg (Germany); 11-14 Sep 1991)			
2	17:6966	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004405	MF-336
3	17:6967	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005170	MF-332
CONF-910909–		(1. international conference on heat-resistant materials; Lake Geneva, WI (United States); 22-26 Sep 1991)			
13	17:6898	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005193	MF-404
CONF-9109102–		(5. annual conference on superconductivity and applications; Buffalo, NY (United States); 24-26 Sep 1991)			
3	17:6959	*See* ANL/CP–73450			
4	17:6963	*See* ANL/CP–74820			
CONF-9109112–		(21. American Wind Energy Association conference: windpower '91; Palm Springs, CA (United States); 24-27 Sep 1991)			
6	17:6549	*See* NREL/TP–257-4625			
7	17:6547	*See* NREL/TP–257-4510			
8	17:6548	*See* NREL/TP–257-4518			
CONF-9109122–		(13. European conference on few-body problems in physics; Elba (Italy); 9-14 Sep 1991)			
5	17:7969	*See* DOE/ER/40427–24-N91			
6	17:7967	*See* DOE/ER/40150–178			
CONF-910920–		(4. topical meeting on tritium technology in fission, fusion, and isotopic applications; Albuquerque, NM (United States); 30 Sep - 4 oct 1991)			
8	17:8320	*See* ANL/CP–72699			
9	17:7142	*See* LBL–31347			
10	17:6406	*See* MLM–3728(OP)			
11	17:6405	*See* MLM–3727(OP)			
12	17:6403	*See* MLM–3723(OP)			
13	17:6404	*See* MLM–3726(OP)			
14	17:6407	*See* MLM–3729(OP)			
CONF-9109209–		(7. international workshop on room temperature - semiconductor X-ray and gamma-ray detectors and associated electronics; Ravello (Italy); 23-28 Sep 1991)			
3	17:7416	*See* EGG–10617-2103			
CONF-910921–		(2. European conference on accelerators in applied research and technology; Frankfurt am Main (Germany); 3-7 Sep 1991)			
1	17:6992	*See* BNL–46226			
CONF-9109211–		(Direct liquefaction contractors' review meeting; Pittsburgh, PA (United States); 3-5 Sep 1991)			
Absts.	17:6161	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003113	MF-108
CONF-9109217–		(Seminar on SCALE-4 and related modular systems for the evaluation of nuclear fuel facilities and package design featuring criticality, shielding and heat transfer capabilities; Gif-sur-Yvette (France); 17-20 Sep 1991)			
2	17:7148	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005122	MF-820
CONF-9109221–		(21. international symposium on multiparticle dynamics; Wuhan (China); 23-27 Sep 1991)			
1	17:7929	*See* ANL-HEP-CP-91-95			

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CONF-9109226–		(AIAA/NASA/OAI conference on advanced space exploration initiative (SEI) technologies; Cleveland, OH (United States); 3-4 Sep 1991)			
22	17:6608	*See* LA-UR–91-2434			
25	17:6606	*See* EGG-M–91428			
CONF-9109229–		(1. Canadian international composites conference and exhibition; Montreal (Canada); 4-6 Sep 1991)			
2	17:6970	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004461	MF-365
CONF-9109230–		(SPIE meeting; Boston, MA (United States); 3-6 Sep 1991)			
7	17:6873	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92003539	
8	17:7500	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003538	MF-406
10	17:7825	*See* UCRL-JC–108128			
CONF-9109234–		(4. Tennessee water resources symposium; Knoxville, TN (United States); 24-26 Sep 1991)			
7	17:7570	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003559	MF-902
CONF-9109250–		(International symposium group theory and special symmetries in nuclear physics; Ann Arbor, MI (United States); 19-21 Sep 1991)			
4	17:7998	*See* BNL–46635			
CONF-9109276–		(Visions of supercomputing conference; Santa Fe, NM (United States); 23-27 Sep 1991)			
8	17:8438	*See* UCRL-JC–108711			
CONF-9109287–		(4. international symposium on the synthesis and applications of isotopes and isotopically labeled compounds; Toronto (Canada); 3 Sep 1991)			
4	17:7090	*See* LBL–31312			
CONF-9109315–		(Vaccines '92; Cold Spring Harbor, NY (United States); 19-23 Sep 1991)			
1	17:7639	*See* LA-UR–91-3716			
CONF-9109316–		(3. International Federation of Automatic Control (IFAC) international workshop on artificial intelligence in real time control; Phonert Park, CA (United States); 23-25 Sep 1991)			
2	17:8436	*See* UCRL-JC–108590			
CONF-9109317–		(4. international workshop on low temperature detectors and dark matter; Oxford (United Kingdom); 4-7 Sep 1991)			
1	17:7390	*See* ANL/CP–74584			
CONF-9109318–		(Department of Energy-Basic Energy Sciences (DOE-BES) workshop on scientific issues on intermetallic compounds: status and forecast for fundamental research; La Jolla, CA (United States); 11-14 Sep 1991)			
1	17:6904	*See* DOE/ER/45213–10			
CONF-9109319–		(8. target fabrication specialists' meeting; Albuquerque, NM (United States); 23-26 Sep 1991)			
1	17:7028	*See* SAND–91-1803C			
2	17:8374	*See* SAND–91-1700C			
CONF-9109320–		(HEPLIB '91 international users meeting on the support and environments of high energy physics computing; Dallas, TX (United States); 19-20 Sep 1991)			
	17:7869	*See* SSCL-SR–1181			
CONF-9109325–		(2. Cycle of conferences and debates about Jacrepagua Lagunes; Rio de Janeiro (Brazil); 16-20 Sep 1991)			
	17:7617	*See* INIS-BR–2882			
CONF-9109328–		(Physics with e^+e^- linear colliders; Hamburg (Germany); 2-4 Sep 1991)			
1	17:7930	*See* BNL–46819			
CONF-910943–		(4. international conference on ion sources; Bensheim (Germany); 30 Sep - 4 oct 1991)			
4	17:8364	*See* LBL–30529			

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
CONF-910945–		(Focus '91: nuclear waste packaging; Las Vegas, NV (United States); 29 Sep - 4 oct 1991)			
2	17:6419	*See* PNL-SA–19867			
4	17:6441	*See* UCRL-JC–106916			
5	17:6440	*See* UCRL-JC–106759			
6	17:6368	*See* ANL/CP–72981			
CONF-910960–		(3. international symposium on aerogels; Wuerzburg (Germany); 30 Sep - 2 oct 1991)			
3	17:7029	*See* SAND–91-2509C			
CONF-910968–		(14. IEEE symposium on fusion engineering; San Diego, CA (United States); 30 Sep - 3 oct 1991)			
48	17:8345	*See* GA-A–20636			
49	17:8340	*See* GA-A–20570			
50	17:8341	*See* GA-A–20587			
51	17:8258	*See* GA-A–20619			
52	17:8344	*See* GA-A–20632			
53	17:8342	*See* GA-A–20607			
54	17:8257	*See* GA-A–20610			
55	17:8343	*See* GA-A–20617			
CONF-910981–		(Environmental remediation '91 conference; Pasco, WA (United States); 8-11 Sep 1991)			
32	17:8448	*See* WHC-SA–1182			
38	17:6450	*See* WHC-SA–1190			
44	17:7612	*See* UCRL-JC–108155			
CONF-911003–		(Fall meeting of the Minerals, Metals and Materials Society of AIME and Materials Week of the American Society of Metals; Cincinnati, OH (United States); 20-24 Oct 1991)			
21	17:6944	*See* SAND–91-0679C			
CONF-9110117–		(2. international conference on uranium hexafluoride handling; Oak Ridge, TN (United States); 29-31 Oct 1991)			
	17:6362	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005283	MF-517
CONF-9110118–		(Accelerator instrumentation workshop; Newport News, VA (United States); 28-31 Oct 1991)			
2	17:7299	*See* BNL–46773			
3	17:7302	*See* BNL–46827			
4	17:7294	*See* ANL/CP–74952			
CONF-9110119–		(US-Japan workshop on nuclear fusion in dense plasmas; Austin, TX (United States); 7-9 Oct 1991)			
	17:8233	*See* DOE/ET/53088–519			
CONF-9110127–		(Conference on global climate change: its mitigation through improved production and utilization of energy; Los Alamos, NM (United States); 21-24 Oct 1991)			
1	17:7555	*See* LA-UR–91-3950			
CONF-9110146–		(7. national conference and exhibition on synchrotron radiation instrumentation; Baton Rouge, LA (United States); 28-31 Oct 1991)			
3	17:7498	*See* ANL/CP–74079			
4	17:7291	*See* ANL/CP–74078			
CONF-9110149–		(66. annual Society of Petroleum Engineers (SPE) technical conference and exhibition; Dallas, TX (United States); 6-9 Oct 1991)			
4	17:6783	*See* EGG–10617-2093			
CONF-9110151–		(Geothermal Resources Council annual meeting and trade show; Reno, NV (United States); 6-9 Oct 1991)			
3	17:6543	*See* LA-UR–91-1990			
CONF-9110152–		(3. international conference on chemistry and migration behavior of actinides and fission products in the geosphere; Jerez de la Frontera (Spain); 21-25 Oct 1991)			
2	17:7596	*See* SAND–91-0430			
CONF-9110153–		(Potential of small nuclear reactors for future clean and safe energy sources; Tokyo (Japan); 23-25 Oct 1991)			
1	17:6599	*See* ANL/CP–74230			

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CONF-9110210–		(1991 water reactor safety meeting; Washington, DC (United States); 28-30 Oct 1991)			
1	17:6708	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002293	
2	17:6758	*See* SAND–91-2461C			
3	17:6757	*See* SAND–91-2407C			
4	17:6759	*See* SAND–91-2613C			
CONF-9110217–		(42. International Aeronautical Federation Congress (IAEFC); Montreal (Canada); 7-11 Oct 1991)			
4	17:6797	*See* EGG-M–91483			
5	17:6607	*See* EGG-M–91485			
6	17:6947	*See* SAND–91-2399C			
CONF-911023–		(23. international technical conference of the Society for the Advancement of Materials and Process Engineering; New York, NY (United States); 22-24 Oct 1991)			
1	17:7016	*See* MLM–3720(OP)			
CONF-9110232–		(Symposium on Relativistic Heavy Ion Collider (RHIC) detector R&D; Upton, NY (United States); 10-11 Oct 1991)			
2	17:7449	*See* LA-UR–91-3553			
3	17:7451	*See* LA-UR–91-3871			
CONF-9110236–		(Working group 3 Joint Coordinating Committee on Nuclear Reactor Safety (JCCNRS) meeting; Oak Ridge, TN (United States); 16-18 Oct 1991)			
2	17:6639	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92001687	
CONF-9110239–		(Solution Mining Research Institute (SMRI) semiannual meeting; Las Vegas, NV (United States); 28-29 Oct 1991)			
2	17:6436	*See* SAND–91-2247C			
CONF-9110243–		(5. International Committee for Future Accelerators (ICFA) beam dynamics workshop; Corpus Christi, TX (United States); 3-8 Oct 1991)			
5	17:7286	*See* SLAC-PUB–5695			
6	17:7268	*See* FNAL/C–91/300			
7	17:7257	*See* BNL–46751			
9	17:7288	*See* SLAC-PUB–5716			
CONF-9110246–		(Nuclear energy agency sorption workshop '91; Interlaken, (Switzerland); 14-22 Oct 1991)			
1	17:6435	*See* SAND–91-2099C			
2	17:6420	*See* PNL-SA–20045			
CONF-9110249–		(International symposium on terminology and documentation in specialized communication; Ontario, (Canada); 7-8 Oct 1991)			
1	17:8439	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004403	MF-400
CONF-9110258–		(Symposium of northeastern accelerator personnel; Albuquerque, NM (United States); 15-19 Oct 1991)			
4	17:7293	*See* ANL/CP–74843			
CONF-9110261–		(International Nuclear Energy Agency nuclear data committee meeting; Karlsruhe (Germany); 19-26 Oct 1991)			
3	17:8324	*See* ANL/CP–74797			
CONF-9110269–		(Northcon 1991; Portland, OR (United States); 1-3 Oct 1991)			
1	17:7590	*See* PNL-SA–19779			
CONF-9110272–		(2. international workshop on principles of diagnosis; Milano (Italy); 14-16 Oct 1991)			
1	17:6659	*See* PNL-SA–19551			
CONF-9110278–		(Clean air act amendments: an economic opportunity for Illinois and the Midwest; Chicago, IL (United States); 11 Oct 1991)			
1	17:6846	*See* ANL/CP–74752			
CONF-9110281–		(Calorimetry and high energy physics conference; Capri (Italy); 14-18 Oct 1991)			
1	17:7917	*See* FNAL/C–91/281			
CONF-9110282–		(16. annual joint firing set conference; Livermore, CA (United States); 15-17 Oct 1991)			
2-Vugraphs	17:7515	*See* SAND–91-2376C			

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CONF-9110283–		(Initial studies of a new type of ignitor: the railplug; Toronto, Ontario (Canada); 7-10 Oct 1991)			
1	17:6874	*See* DOE/ER/12115–1			
CONF-9110291–		(Federal Construction Council symposium on dealing with environmental concerns in the comprehensive; Washington, DC (United States); 31 Oct 1991)			
1	17:6779	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002810	MF-402
CONF-9110295–		(Advances in aids vaccine development; Marcos Island, FL (United States); 15-19 Oct 1991)			
1	17:7638	*See* LA-UR–91-3715			
CONF-9110296–		(European Southern Observatory (ESO) conference on high resolution imaging by interferometry II; Garching (Germany); 14-18 Oct 1991)			
1	17:7497	*See* UCRL-JC–108740			
CONF-9110299–		(1991 Asia energy conference; Bangkok (Thailand); 17-20 Oct 1991)			
1	17:6517	*See* SAND–91-2408C			
CONF-9110300–		(SCAN '91: international symposium on computer arithmetic and scientific computing; Oldenburg (Germany); 1-4 Oct 1991)			
1	17:8393	*See* ANL/CP–74795			
2	17:8392	*See* ANL/CP–74794			
CONF-9110301–		(Advanced metallization for ULSI applications conference; Newark, NJ (United States); 7-19 Oct 1991)			
1	17:6946	*See* SAND–91-2263C			
CONF-9110306–		(7. US-Japan workshop on high-field superconductors; Fukuoka (Japan); 21-23 Oct 1991)			
1	17:6897	*See* BNL–46846			
CONF-9110308–		(International conference on toxicology of combustion processes; Pavia (Italy); 28-30 Oct 1991)			
1	17:7801	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004255	MF-408; MF-402
CONF-9110310–		(Gamma ray burst conference; Huntsville, AL (United States); 17-18 Oct 1991)			
1	17:7861	*See* LA-UR–91-4165			
CONF-9110311–		(Parkins symposium on fundamentals; Cincinnati, OH (United States); 20-24 Oct 1991)			
1	17:6942	*See* PNL-SA–19782			
CONF-9110313–		(NATO workshop on recombination of atomic ions; Belfast (Ireland); 6-9 Oct 1991)			
1	17:8149	*See* LA-UR–91-3849			
CONF-9110317–		(International supercomputer users group meeting; Dallas, TX (United States); 7-9 Oct 1991)			
1	17:7903	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005128	MF-413
CONF-911043–		(30. Hanford symposium on health and the environment: current topics in occupational health; Richland, WA (United States); 29 Oct - 1 nov 1991)			
4	17:7806	*See* PNL-SA–19355			
CONF-911047–		(180. meeting of the Electrochemical Society; Phoenix, AZ (United States); 13-18 Oct 1991)			
9	17:6499	*See* BNL–46778			
CONF-911049–		(7. symposium on separation science and technology for energy applications; Knoxville, TN (United States); 20-24 Oct 1991)			
3	17:6361	*See* PNL-SA–19681			
4	17:6367	*See* ANL/CP–72834			
5	17:7614	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004763	MF-901
CONF-911055–		(22. IEEE photovoltaic specialists conference; Las Vegas, NV (United States); 7-11 Oct 1991)			
10	17:6532	*See* SAND–91-2211C			

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CONF-911071–		(American Chemical Society symposium on emerging technologies for hazardous waste management; Atlanta, GA (United States); 1-3 Oct 1991)			
5	17:6851	*See* ANL/CP–72550			
CONF-911079–		(19. Nuclear Regulatory Commission (NRC) water reactor safety information meeting; Bethesda, MD (United States); 28-30 Oct 1991)			
1	17:6706	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92001975	
4	17:6644	*See* PNL-SA–20093			
6	17:6707	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002806	
9	17:6716	*See* EGG-M–91501			
11	17:6756	*See* SAND–91-1610C			
12	17:6754	*See* SAND–91-1397C			
13	17:6704	*See* ANL/CP–74781			
15	17:6755	*See* SAND–91-1459C			
17	17:6637	*See* BNL-NUREG–46331			
CONF-911096–		(4. international symposium on superconductivity; Tokyo (Japan); 14-17 Oct 1991)			
4	17:6961	*See* ANL/CP–74636			
5	17:6763	*See* BNL–46823			
CONF-911104–		(Nuclear energy forum: a new strategy to build on; San Francisco, CA (United States); 10-14 Nov 1991)			
2	17:6656	*See* GA-A–20717			
CONF-911106–		(IEEE nuclear science symposium; Santa Fe, NM (United States); 5-9 Nov 1991)			
14	17:6596	*See* ANL/CP–69863			
15	17:7388	*See* ANL/CP–74511			
16	17:7450	*See* LA-UR–91-3657			
18	17:7447	*See* LA-UR–91-3489			
20	17:7170	*See* RFP–4509			
29	17:7212	*See* LA-UR–91-3526			
30	17:7448	*See* LA-UR–91-3514			
31	17:7365	*See* SLAC-PUB–5698			
32	17:7254	*See* SLAC-PUB–5709			
35	17:7527	*See* ANL/CP–73505			
36	17:6474	*See* LA-UR–91-3559			
37	17:7419	*See* FNAL/C–91/302			
38	17:7418	*See* FNAL/C–91/297			
39	17:7423	*See* FNAL/C–91/317			
40	17:7311	*See* FNAL/C–91/311			
41	17:7290	*See* ANL/CP–73788			
42	17:7454	*See* LBL–31415			
44	17:7453	*See* LBL–31383			
45	17:7452	*See* LBL–30606			
46	17:7421	*See* FNAL/C–91/315			
47	17:7425	*See* FNAL/C–91/320			
48	17:7422	*See* FNAL/C–91-316			
49	17:7420	*See* FNAL/C–91/314			
50	17:7424	*See* FNAL/C–91/319			
51	17:7469	*See* SLAC-PUB–5678			
53	17:7298	*See* BNL–46750			
CONF-911107–		(Winter meeting of the American Nuclear Society (ANS); San Francisco, CA (United States); 10-15 Nov 1991)			
35	17:8377	*See* ANL/CP–73778			
44	17:6630	*See* EGG-M–91053			
48	17:7177	*See* UCRL-JC–108735			
49	17:7407	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004401	MF-400
50	17:6371	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004347	MF-902
CONF-911109–		(Fall meeting of the European Materials Research Society; Strasbourg (France); 5-8 Nov 1991)			
5	17:6402	*See* LA-UR–91-4035			
6	17:7063	*See* ANL/CP–73404			
7	17:7064	*See* ANL/CP–74763			
CONF-9111105–		(Carribean Haztech conference; San Juan (Puerto Rico); 13-15 Nov 1991)			
2	17:6374	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003567	MF-800

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CONF-911111–		(International conference on fusion reactor materials; Clearwater, FL (United States); 17-22 Nov 1991)			
10	17:8322	*See* ANL/CP–72828			
11	17:8323	*See* ANL/CP–72864			
12	17:8321	*See* ANL/CP–72824			
13	17:8319	*See* ANL/CP–70626			
14	17:8370	*See* PNL-SA–19387			
15	17:8368	*See* PNL-SA–19346			
16	17:8371	*See* PNL-SA–19571			
17	17:8369	*See* PNL-SA–19386			
18	17:8326	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005121	MF-423
CONF-9111124–		(1991 RELAP5/TRAC-B international users seminar; Baton Rouge, LA (United States); 4-8 Nov 1991)			
1	17:6715	*See* EGG-M–91489			
3	17:6714	*See* EGG-M–91370			
CONF-9111125–		(20. Japan conference on radiation and radioisotopes; Tokyo (Japan); 12-14 Nov 1991)			
1	17:7389	*See* ANL/CP–74572			
CONF-9111126–		(15. annual TRADE (training resources and data exchange) conference; St. Petersburg, FL (United States); 18-20 Nov 1991)			
1	17:8391	*See* WHC-SA–1403			
2	17:7540	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003511	
3	17:8383	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003561	MF-400
6	17:7808	*See* PNL-SA–20116			
CONF-9111127–		(33. annual Division of Plasma Physics/American Physical Society (DPP/APS) meeting; Tampa, FL (United States); 4-8 Nov 1991)			
4	17:8318	*See* UW-CPTC–91-18			
6	17:8224	*See* DOE/ER/53198–184			
CONF-9111128–		(International Atomic Energy conference; Mito (Japan); 5-7 Nov 1991)			
1	17:6600	*See* ANL/CP–74690			
CONF-9111129–		(FAA explosives detection symposium; Atlantic City, NJ (United States); 13-15 Nov 1991)			
1	17:7526	*See* SAND–91-2486C			
2	17:7467	*See* SAND–91-2451C			
4	17:7041	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92004408	MF-401
CONF-911113–		(9. international conference on ultra relativistic nucleus-nucleus collisions; Gatlinburg, TN (United States); 11 Nov 1991)			
1	17:8055	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005159	MF-413
CONF-9111131–		(Canadian Wind Energy Association (CWEA) meeting; Montreal (Canada); 4 Nov 1991)			
1	17:6550	*See* SAND–91-2386C			
CONF-9111133–		(2. U.S./Japan specialized topic workshop on pressurized thermal shock; San Diego, CA (United States); 14 Nov 1991)			
2	17:6709	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004222	
CONF-9111137–		(Western Area Power Administration Conservation and Renewable Energy Program integrated resource planning seminar; Sacramento, CA (United States); 19-20 Nov 1991)			
4-Extd.Abst.	17:6867	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004224	MF-350
CONF-911114–		(13. annual DOE low-level waste management conference; Atlanta, GA (United States); 19-21 Nov 1991)			
1	17:6434	*See* SAND–91-1827C			
CONF-9111141–		(Workshop on long-baseline neutrino oscillations; Batavia, IL (United States); 17-20 Nov 1991)			
1	17:7995	*See* SLAC-PUB–5710			
CONF-9111144–		(Annual meeting of the Mid-South Educational Research Association; Lexington, KY (United States); 13-15 Nov 1991)			
2	17:6774	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004762	MF-400
CONF-9111146–		(Meeting of coordinate research program on long lived radionuclides for fusion; Vienna (Austria); 11-12 Nov 1991)			
1	17:8052	*See* ANL/CP–73902			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-9111147–		(Harmonizing economic competitiveness with environmental quality: a North American Challenge; Santa Fe, NM (United States); 8-9 Nov 1991)			
1	17:8380	*See* LA-UR–91-3693			
CONF-9111148–		(2. foresight conference on molecular nanotechnology; Palo Alto, CA (United States); 7-9 Nov 1991)			
1	17:7635	*See* ANL/CP–74444			
CONF-9111149–		(14. international meeting on reduced enrichment for research and test reactors; Jakarta (Indonesia); 4-7 Nov 1991)			
1	17:6594	*See* ANL/CP–74816			
2	17:6668	*See* ANL/CP–74817			
3	17:6669	*See* ANL/CP–74818			
4	17:6670	*See* ANL/CP–74819			
CONF-9111158–		(1991 U.S. Army chemical research conference on chemical defense; Aberdeen Proving Ground, MD (United States); 19-22 Nov 1991)			
1	17:7571	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004442	
CONF-911116–		(International conference on accelerator and large experimental physics control systems; Tsukuba (Japan); 11-15 Nov 1991)			
14	17:7287	*See* SLAC-PUB–5700			
15	17:7295	*See* BNL–46121			
CONF-9111164–		(International workshop on studies of magnetic properties of fine particles and their relevance to materials science; Rome (Italy); 4-8 Nov 1991)			
1	17:8194	*See* LA-UR–91-3851			
2	17:6894	*See* ANL/CP–74482			
CONF-9111165–		(Quark matter '91; Gatlinburg, TN (United States); 11-15 Nov 1991)			
1	17:7959	*See* LA-UR–91-3962			
CONF-911132–		(38. national symposium of the American Vacuum Society; Seattle, WA (United States); 11-15 Nov 1991)			
7	17:8373	*See* SAND–91-1163C			
8	17:7499	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004404	MF-408
9	17:8346	*See* GA-A–20750			
10	17:7094	*See* SAND–91-2493C			
11	17:6899	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005114	MF-404
CONF-911133–		(American Institute of Chemical Engineers (AIChE) annual meeting; Los Angeles, CA (United States); 17-22 Nov 1991)			
8	17:7566	*See* ANL/CP–73172			
9	17:7062	*See* ANL/CP–72789			
CONF-911154–		(International conference on evolution in beam applications; Takasaki (Japan); 5-8 Nov 1991)			
1	17:6993	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003529	MF-404
CONF-911179–		(Life prediction of corrodible structures; Kauai, HI (United States); 5-8 Nov 1991)			
2	17:6943	*See* PNL-SA–20244			
CONF-911180–		(Specialty conference on tropospheric ozone and the environment; Atlanta, GA (United States); 5-7 Nov 1991)			
1	17:7800	*See* ANL/CP–74664			
CONF-911184–		(13. annual North American conference of the International Association for Energy Economics; Chicago, IL (United States); 18-20 Nov 1991)			
6	17:6283	*See* ANL/CP–74713			
7	17:6568	*See* ANL/CP–74787			
CONF-911202–		(Annual fall meeting of the Materials Research Society; Boston, MA (United States); 2-6 Dec 1991)			
4	17:7027	*See* SAND–91-1635C			
5	17:8195	*See* SAND–91-1508C			
6	17:7026	*See* SAND–91-1477C			
7	17:8156	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004240	MF-406; MF-404

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
8	17:7030	*See* SAND–91-2826C			
9	17:7025	*See* SAND–91-1392C			
12	17:7013	*See* LA-UR–91-3982			
13	17:6900	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005102	MF-404
14	17:6968	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005126	MF-404
15	17:6901	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005172	MF-404
16	17:7188	*See* ANL/CP–73611			
17	17:6896	*See* ANL/CP–74998			
18	17:6960	*See* ANL/CP–73624			
19	17:6893	*See* ANL/CP–73625			
20	17:6964	*See* ANL/CP–74977			
21	17:6994	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005168	MF-404
23	17:8180	*See* BNL–46352			
CONF-911208–		(International symposium on hypernuclear and strange particle physics; Shimoda (Japan); 9-12 Dec 1991)			
1	17:7997	*See* ANL/CP–74387			
CONF-911213–		(American Society of Mechanical Engineers (ASME) annual winter meeting; Atlanta, GA (United States); 1-6 Dec 1991)			
17	17:6713	*See* EGG-M–91216			
18	17:7147	*See* ANL/CP–73489			
19	17:6958	*See* ANL/CP–72939			
20	17:6948	*See* SAND–91-2533C			
CONF-911214–		(International conference on plant life extension (PLEX): upgrading, repair, refurbishment, uprating and ageing; Berlin (Germany); 2-4 Dec 1991)			
1	17:6597	*See* ANL/CP–73414			
CONF-911226–		(SO_2 control symposium; Washington, DC (United States); 3-6 Dec 1991)			
1	17:6230	*See* ANL/CP–72760			
CONF-911231–		(Technology 2000; San Jose, CA (United States); 3-5 Dec 1991)			
1	17:7680	OSTI; NTIS; GPO Dep.	E 1.99:	DE92002707	MF-902
4	17:6965	*See* BNL–46855			
CONF-911256–		(International chlorofluorocarbon (CFC) and halon alternatives conference; Baltimore, MD (United States); 3-5 Dec 1991)			
3	17:6853	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004350	MF-350
4	17:6840	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004477	MF-350
CONF-911266–		(1. European conference on artificial life; Paris (France); Dec 1991)			
1	17:7644	*See* LA-UR–91-3391			
CONF-911268–		(CERS '91: Chinese experts radwaste symposium; Taipei (China); 17-18 Dec 1991)			
1	17:6372	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003026	MF-902
CONF-911269–		(Precision time and time interval (PTTI) meeting; Pasadena, CA (United States); 3-5 Dec 1991)			
1	17:7529	*See* LA-UR–91-3749			
CONF-911270–		(Geothermal energy peer review; Salt Lake City, UT (United States); 4 Dec 1991)			
1	17:7066	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004342	MF-252
CONF-911271–		(FedUNIX/Motif '91; Washington, DC (United States); 8-12 Dec 1991)			
1	17:7292	*See* ANL/CP–74827			
CONF-911272–		(International symposium on ultra-high temperature materials; Tajimi City (Japan); 7 Dec 1991)			
1	17:6995	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004445	MF-404
CONF-911273–		(Solvent substitution workshop; Phoenix, AZ (United States); 12 Dec 1991)			
1	17:6365	*See* RFP–4530			
CONF-911277–		(Solid state physics symposium; Bombay (India); 21-24 Dec 1991)			
1	17:8182	*See* BNL–46728			
CONF-920104–		(9. symposium on space nuclear power systems; Albuquerque, NM (United States); 13-16 Jan 1992)			
17-Rev.1	17:6836	*See* WHC-SA–1257-Rev.1			
18	17:6609	*See* SAND–91-2315C			

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20	17:6698	*See* SAND–91-2310C			
21	17:6793	*See* EGG-M–91482			
22	17:6924	*See* IS-M–676			
23	17:6610	*See* WHC-SA–1402			
3-Rev.1	17:6624	*See* WHC-SA–1266-Rev.1			
4-Rev.1	17:6497	*See* WHC-SA–1259-Rev.1			
CONF-920108–		(International air conditioning, heating, refrigerating exposition; Anaheim, CA (United States); 25-29 Jan 1992)			
2	17:6841	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004478	MF-350
CONF-920124–		(Society of Photo-Optical Instrumentation Engineers' international symposium on laser spectroscopy as part of SPIE's symposium on optics, electro-optics and laser applications in science and engineering; Los Angeles, CA (United States); 19-24 Jan 1992)			
1	17:7358	*See* LA-UR–91-4150			
2	17:7065	*See* BNL–47044			
3	17:8171	*See* LA-UR–91-4097			
4	17:8151	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005116	MF-410
CONF-920145–		(Making information work; Washington, DC (United States); 21-23 Jan 1992)			
1	17:8449	*See* WHC-SA–1292			
2	17:7541	*See* UCRL-JC–108358			
CONF-920151–		(7. annual battery conference on applications; Long Beach, CA (United States); 21-23 Jan 1992)			
1	17:6768	*See* SAND–91-2529C			
CONF-920153–		(71. annual meeting of the Transportation Research Board; Washington, DC (United States); 14 Jan 1992)			
2	17:6847	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004233	
CONF-920202–		(IEEE Power Engineering Society (PES) winter meeting; New York, NY (United States); 2-6 Feb 1992)			
2	17:6764	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003530	MF-220
CONF-920221–		(2. national research and development conference on the control of hazardous materials; San Francisco, CA (United States); 4-6 Feb 1992)			
1	17:7611	*See* UCRL-JC–107037			
CONF-920223–		(1992 hardened electronics and radiation technology (HEART) conference; Albuquerque, NM (United States); 24-28 Feb 1992)			
2	17:6761	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003541	MF-220
CONF-920227–		(6. international photovoltaic science and engineering conference; New Delhi (India); 10-14 Feb 1992)			
1	17:6518	*See* SAND–91-2599C			
2	17:6530	*See* SAND–91-2515C			
3	17:6527	*See* NREL/TP–214-4610			
CONF-920234–		(10. international modal analysis conference (IMAC); San Diego, CA (United States); 3-6 Feb 1992)			
2	17:7218	*See* SAND–91-1367C			
CONF-920247–		(National electronics products conference (NEPCON) west; Anaheim, CA (United States); 23-27 Feb 1992)			
1	17:6949	*See* SAND–91-2606C			
2	17:6950	*See* SAND–91-2661C			
3	17:6951	*See* SAND–91-2752C			
CONF-920250–		(1992 Society of Petroleum Engineers (SPE) drilling conference; New Orleans, LA (United States); 18-21 Feb 1992)			
1	17:6544	*See* SAND–91-1848C			
CONF-920302–		(43. Pittsburgh conference and exposition on analytical chemistry and applied spectroscopy; New Orleans, LA (United States); 9-13 Mar 1992)			
1-Extd.Abst.	17:7058	*See* POEF-T–3581-Extd.Abst.			

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
CONF-920305–		(Minerals, Metals, and Materials Society (TMS) annual meeting and exhibition; San Diego, CA (United States); 1-5 Mar 1992)			
1	17:6923	*See* IS-M–672			
2	17:6861	*See* EGG-M–91315			
CONF-920307–		(Waste management '92; Tucson, AZ (United States); 1-5 Mar 1992)			
1	17:6373	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91018172	MF-402
2	17:6854	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004483	MF-721
CONF-920308–		(Advances in reactor physics; Charleston, SC (United States); 8-11 Mar 1992)			
1	17:6598	*See* ANL/CP–73424			
2	17:8122	OSTI; NTIS; GPO Dep.	E 1.99:	DE91015925	MF-405
3	17:6651	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92001957	MF-523
4	17:8129	*See* KAPL–4731			
5	17:6333	*See* WHC-SA–1379			
6	17:6652	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003406	MF-406; MF-413
7	17:6673	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004232	MF-400
CONF-920311–		(10. international conference on plasma-surface interactions in controlled fusion devices; Monterey, CA (United States); 30 Mar - 3 apr 1992)			
1	17:8298	*See* LA-UR–91-4080			
CONF-920330–		(8. IEEE conference on artificial intelligence for applications; Monterey, CA (United States); 2-6 Mar 1992)			
1	17:7636	OSTI; NTIS; GPO Dep.	E 1.99:	DE91018850	MF-408
CONF-920332–		(1992 American Society for Photogrammetry and Remote Sensing/American Congress on Surveying and Mapping (ASPRS/ACSM) annual convention; Albuquerque, NM (United States); 3-5 Mar 1992)			
1	17:7364	*See* SLAC-PUB–5640			
CONF-920351–		(1992 IEEE position, location and navigation symposium; Monterey, CA (United States); 24-27 Mar 1992)			
1	17:7514	*See* SAND–91-2303C			
CONF-920354–		(1992 IEEE international conference on acoustics, speech and signal processing; San Francisco, CA (United States); 23-26 Mar 1992)			
1	17:8420	*See* SAND–91-1633C			
2	17:7859	*See* LA-UR–91-3692			
CONF-920367–		(Department of Defense (DOD) fiber optics conference; McLean, VA (United States); 25 Mar 1992)			
1	17:7475	*See* SAND–91-2705C			
CPTH–					
A050.0491.	17:7877	*See* IC–91/124			
CRIE-U–					
90054	17:6500	OSTI; NTIS (US Sales Only)		DE92749206	
CRIE-Y–					
90018	17:6868	OSTI; NTIS (US Sales Only)		DE92749205	
CSNAS–					
0031.	17:7687	*See* CNIC–00404			
0032.	17:7567	*See* CNIC–00413			
0033.	17:7568	*See* CNIC–00419			
0034.	17:7132	*See* CNIC–00432			
0035.	17:7688	*See* CNIC–00437			
0036.	17:7743	*See* CNIC–00440			
CTA-IEAV-NT–					
006/91	17:6628	OSTI; NTIS (US Sales Only); INIS		DE92613776	
CTH-IEFT-PP–					
1991-09	17:8210	OSTI; NTIS (US Sales Only); INIS		DE92614462	
1991-15	17:8211	OSTI; NTIS (US Sales Only); INIS		DE92614463	
1991-16	17:8212	OSTI; NTIS (US Sales Only); INIS		DE92614456	
1991-17	17:8213	OSTI; NTIS (US Sales Only); INIS		DE92614457	
1991-18	17:8214	OSTI; NTIS (US Sales Only); INIS		DE92614439	
1991-19	17:8215	OSTI; NTIS (US Sales Only); INIS		DE92614458	

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CTH-RF–					
76	17:8216	OSTI; NTIS (US Sales Only); INIS		DE92614442	
81	17:8217	OSTI; NTIS (US Sales Only); INIS		DE92614443	
82	17:8218	OSTI; NTIS (US Sales Only); INIS		DE92614444	
83	17:8219	OSTI; NTIS (US Sales Only); INIS		DE92614445	
84	17:8220	OSTI; NTIS (US Sales Only); INIS		DE92614446	
85	17:8221	OSTI; NTIS (US Sales Only); INIS		DE92614447	
86	17:7409	OSTI; NTIS (US Sales Only); INIS		DE92615123	
DESY–					
91-074	17:7904	OSTI; NTIS (US Sales Only); INIS		DE92758901	
91-078	17:7936	OSTI; NTIS (US Sales Only); INIS		DE92758900	
91-079	17:7841	OSTI; NTIS (US Sales Only)		DE92758919	
91-080	17:7937	OSTI; NTIS (US Sales Only); INIS		DE92758903	
91-082	17:7826	OSTI; NTIS (US Sales Only); INIS		DE92758902	
91-083	17:7410	OSTI; NTIS (US Sales Only); INIS		DE92758918	
91-085	17:7938	OSTI; NTIS (US Sales Only); INIS		DE92758899	
91-088	17:7872	OSTI; NTIS (US Sales Only); INIS		DE92758963	
91-093	17:7965	OSTI; NTIS (US Sales Only); INIS		DE92758962	
91-113	17:7873	OSTI; NTIS (US Sales Only); INIS		DE92759312	
DLR-FB–					
91-06	17:6514	OSTI; NTIS (US Sales Only)		DE92759011	
DOE-HMIP-RR–					
91.034	17:6377	OSTI; NTIS (US Sales Only); INIS		DE92615146	
91.035	17:6662	OSTI; NTIS (US Sales Only); INIS		DE92614966	
DOE/BC/14202–					
6	17:6296	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001007	PC-122
DOE/BC/14246–					
T10	17:6297	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004433	MF-122
DOE/BC/14479–					
7	17:6317	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003697	MF-122
DOE/BP–					
1677	17:6869	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005359	MF-350
DOE/BP/39339–					
5	17:6508	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005362	MF-902
DOE/CE–					
40762T-H4	17:6855	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004697	PC-310
DOE/CE/15348–					
T8	17:6848	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004434	MF-336
DOE/CE/15449–					
T8	17:6849	OSTI; NTIS; GPO Dep.	E 1.99:	DE92000160	MF-330
DOE/CE/15459–					
T4	17:6313	OSTI; NTIS; GPO Dep.	E 1.99:	DE92000397	MF-334
DOE/CE/40938–					
1	17:6311	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004027	MF-321
DOE/CH/10093–					
120	17:6842	OSTI; NTIS; GPO Dep.	E 1.99:	DE91015024	MF-350
87	17:6856	OSTI; NTIS; GPO Dep.	E 1.99:	DE91002107	PC-310
DOE/DP–					
0091T	17:6710	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92001854	MF-700
0093T	17:6711	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92004072	MF-700
0094P	17:6674	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92004779	MF-700
DOE/EA–					
0540	17:6375	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003906	MF-603
DOE/EH–					
0206	17:8384	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003032	MF-600
0219	17:6780	OSTI (Free of Charge); INIS		TI92003780	PC-630
0220	17:6781	OSTI (Free of Charge); INIS		TI92004711	MF-630
0227P	17:6782	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004780	MF-600
DOE/EI/22627–					
T1	17:6302	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005261	MF-950
DOE/EIA–					
0035(91/11)	17:6807	OSTI; NTIS; INIS; GPO; GPO Dep.	E 1.99:	DE92004651	MF-950
0035(91/12)	17:6808	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE92004204	MF-950
0109(91/11)	17:6809	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE92003960	MF-950
0109(91/12)	17:6810	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE92004926	MF-950
0121(91/2Q)	17:6286	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE92003716	MF-950
0130(91/11)	17:6811	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE92004165	MF-950
0202(91)	17:6812	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE92003655	MF-950
0226(91/11)	17:6823	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE92003715	MF-950
0292(89)	17:6098	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE92004652	MF-950
0370(91)	17:6292	OSTI; NTIS; INIS; GPO; GPO Dep.	E 1.99:	DE92004898	MF-950

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0380(91/12)	17:6813	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE92005134	MF-950
0487(90)	17:6814	OSTI; NTIS; INIS; GPO; GPO Dep.	E 1.99:	DE92005324	MF-950
0520(91/11)	17:6815	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE92003717	MF-950
0520(91/12)	17:6816	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE92004164	MF-950
0538(91/92-10)	17:6818	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003959	MF-950
0538(91/92-11)	17:6819	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE92004725	MF-950
0538(91/92-12)	17:6820	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE92004812	MF-950
0538(91/92-13)	17:6304	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE92004205	MF-950
0538(91/92-14)	17:6305	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE92004841	MF-950
0538(91/92-7)	17:6303	OSTI; NTIS; INIS; GPO; GPO Dep.	E 1.99:	DE92003390	MF-950
0538(91/92-9)	17:6817	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004689	MF-950
0543(91/3Q)	17:6821	OSTI; NTIS; INIS; GPO; GPO Dep.	E 1.99:	DE92004795	MF-950
0550	17:6309	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE92003942	MF-950
0552(80-88)	17:6857	OSTI; NTIS; GPO; GPO Dep.	E 1.99:	DE92004501	MF-950
DOE/EIA-M–					
048	17:6287	OSTI; NTIS; INIS; GPO; GPO Dep.	E 1.99:	DE92003555	MF-950
DOE/ER–					
0249(91)	17:8379	OSTI (Free of Charge)		TI92004796	PC-400
0512T	17:7544	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004111	PC-402
DOE/ER/02289–					
15	17:7866	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004203	MF-414
DOE/ER/10699–					
T10	17:7411	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004331	MF-414
DOE/ER/12027–					
6	17:7647	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004298	MF-401
DOE/ER/12107–					
1	17:6997	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004046	MF-404
DOE/ER/12115–					
1	17:6874	OSTI; NTIS; GPO Dep.	E 1.99:	DE92002578	MF-406
DOE/ER/12809–					
4	17:6653	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004026	MF-400
DOE/ER/12812–					
T1	17:6376	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004435	MF-413
DOE/ER/12822–					
T1	17:6640	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004100	MF-406
DOE/ER/12888–					
T1	17:6629	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004450	MF-406
DOE/ER/12889–					
11	17:6654	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003996	MF-405
DOE/ER/13204–					
6	17:7642	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004033	MF-408
DOE/ER/13323–					
6	17:7067	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003751	MF-401
DOE/ER/13463–					
8	17:7042	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004045	MF-401
DOE/ER/13482–					
6	17:6998	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005467	MF-406
DOE/ER/13491–					
508	17:8143	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004028	MF-411
DOE/ER/13507–					
7	17:7068	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004057	MF-401
DOE/ER/13514–					
T1	17:7069	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003767	MF-401
DOE/ER/13527–					
T1	17:7143	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003763	MF-406
DOE/ER/13592–					
6	17:7099	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004030	MF-401
DOE/ER/13649–					
5	17:7043	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004423	MF-401
DOE/ER/13667–					
T4	17:7812	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003468	MF-403
DOE/ER/13673–					
T2	17:6298	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005268	MF-406
DOE/ER/13676–					
3	17:6858	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004314	MF-401
DOE/ER/13766–					
9	17:7070	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005340	MF-401
DOE/ER/13772–					
4	17:7545	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005077	MF-401; MF-404

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
DOE/ER/13775–					
4	17:7071	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004068	MF-401
DOE/ER/13796–					
1	17:7813	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003436	MF-403
DOE/ER/13807–					
T1	17:7814	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003394	MF-403
T2	17:7815	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003393	MF-403
T3	17:7816	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003392	MF-403
DOE/ER/13809–					
T1	17:7072	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004327	MF-404
DOE/ER/13840–					
2	17:7817	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004246	MF-402
DOE/ER/13849–					
4	17:8144	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005083	MF-401
DOE/ER/13855–					
4	17:7097	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005303	MF-401
5	17:7073	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005304	MF-401
DOE/ER/13860–					
4	17:7100	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004080	MF-411
DOE/ER/13880–					
4	17:7074	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005079	MF-401
DOE/ER/13913–					
4	17:7179	OSTI; NTIS; GPO Dep.	E 1.99:	DE91019081	MF-406
DOE/ER/13935–					
3	17:7075	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005300	MF-401
DOE/ER/13945–					
3	17:7076	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005305	MF-401
DOE/ER/13964–					
3	17:8136	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001742	MF-406
DOE/ER/14017–					
3	17:8197	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004064	MF-411
DOE/ER/14045–					
5	17:7481	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005085	MF-406
DOE/ER/14056–					
10	17:7044	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004017	MF-401
DOE/ER/14066–					
1	17:8137	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004834	MF-411
2	17:8138	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004836	MF-411
3	17:8139	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004206	MF-411
DOE/ER/14100–					
1	17:8157	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004077	MF-405
DOE/ER/14117–					
T1	17:7077	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003762	MF-404; MF-401
T2	17:7078	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004337	MF-401
DOE/ER/14135–					
T1	17:6902	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004428	MF-406
DOE/ER/14154–					
T1	17:6542	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003770	MF-403
DOE/ER/14185–					
1	17:6999	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004019	MF-406
DOE/ER/25018–					
4	17:8395	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004839	MF-405
DOE/ER/25041–					
3	17:8396	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005418	MF-405
DOE/ER/25061–					
T1	17:8158	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004391	MF-405
DOE/ER/25063–					
T11	17:8440	OSTI; NTIS; GPO Dep.	E 1.99:	DE91014347	MF-405
DOE/ER/40107–					
10A	17:7966	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004055	MF-414
10B	17:7874	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004049	MF-414
DOE/ER/40150–					
178	17:7967	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005090	MF-414
DOE/ER/40153–					
8	17:7875	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004070	MF-414
DOE/ER/40158–					
9	17:7939	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004415	MF-414
DOE/ER/40243–					
8	17:7968	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004413	MF-414

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
DOE/ER/40246–					
6	17:8057	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004418	MF-413
DOE/ER/40257–					
6	17:7412	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004833	MF-414
DOE/ER/40330–					
50	17:8001	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003673	MF-413
DOE/ER/40343–					
5	17:8058	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004061	MF-413
DOE/ER/40353–					
9	17:8059	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004059	MF-413
DOE/ER/40389–					
71	17:7940	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005081	MF-413
DOE/ER/40402–					
4	17:7133	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004393	MF-401
DOE/ER/40403–					
T3	17:8060	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004819	MF-413
DOE/ER/40405–					
T4	17:8002	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004332	MF-413
T5	17:8003	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004109	MF-413
DOE/ER/40410–					
3	17:8061	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005088	MF-413
DOE/ER/40415–					
7	17:8062	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005084	MF-413
DOE/ER/40423–					
27	17:7941	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004395	MF-414
DOE/ER/40427–					
21-N91	17:7972	*See* DOE/ER/40561–24			
24-N91	17:7969	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004272	MF-413
25-N91	17:8064	*See* DOE/ER/40561–27			
30-N91	17:7905	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004273	MF-413
DOE/ER/40444–					
4-Add.	17:7942	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92006451	MF-413
DOE/ER/40448–					
4	17:7906	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004490	MF-414
DOE/ER/40454–					
T1	17:8063	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005468	MF-413
DOE/ER/40496–					
1	17:7842	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005344	MF-412
DOE/ER/40513–					
1	17:7413	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004023	MF-414
DOE/ER/40527–					
T2	17:7304	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003774	MF-414
DOE/ER/40561–					
15	17:8004	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004368	MF-413
16	17:7907	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004369	MF-413
17	17:8005	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004370	MF-413
20	17:7970	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004373	MF-413
21	17:7971	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004374	MF-413
22	17:7908	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004375	MF-414
23	17:7909	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004376	MF-414
24	17:7972	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004377	MF-414
25	17:7910	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004378	MF-414
26	17:7911	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004379	MF-414
27	17:8064	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004382	MF-414
28	17:7912	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004383	MF-414
29	17:7973	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004384	MF-414
30	17:7974	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004385	MF-414
31	17:7913	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004386	MF-414
32	17:7914	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004387	MF-414
33	17:7915	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004389	MF-414
DOE/ER/40614–					
2	17:7943	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004269	MF-414
8	17:7944	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004253	MF-414
10	17:7916	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004266	MF-414
DOE/ER/40633–					
1	17:7867	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004426	MF-414
DOE/ER/40640–					
1	17:8006	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004025	MF-413
DOE/ER/40675–					
1	17:7414	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004075	MF-414

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
DOE/ER/45095–					
6	17:6903	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005531	MF-404
DOE/ER/45209–					
6	17:6971	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005080	MF-404
DOE/ER/45213–					
10	17:6904	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004157	MF-404
T2	17:6905	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004020	MF-404
DOE/ER/45220–					
8	17:7000	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005076	MF-404
DOE/ER/45228–					
9	17:6972	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004069	MF-404
DOE/ER/45239–					
7	17:6906	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005075	MF-404
DOE/ER/45275–					
5	17:8159	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004388	MF-410
DOE/ER/45308–					
5	17:6907	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005082	MF-404
DOE/ER/45310–					
35	17:6908	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004420	MF-404
DOE/ER/45338–					
1	17:6973	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004053	MF-404
DOE/ER/45387–					
T1	17:6909	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004328	MF-404
DOE/ER/45409–					
2	17:7001	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004687	MF-404
DOE/ER/45437–					
1	17:8160	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004074	MF-410
DOE/ER/45439–					
1	17:6890	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004051	MF-410
DOE/ER/45445–					
3	17:7975	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004842	MF-413
DOE/ER/52111–					
3	17:8327	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004202	MF-419
DOE/ER/52143–					
T1	17:8328	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004308	MF-423
DOE/ER/52154–					
T4	17:8329	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004060	MF-425
DOE/ER/53198–					
179	17:8222	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004056	MF-426
183	17:8223	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005231	PC-426; PC-427
184	17:8224	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005230	PC-426
185	17:8225	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005229	PC-426; PC-427
DOE/ER/53211–					
10	17:8226	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005299	MF-420
DOE/ER/53212–					
178	17:8227	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004419	MF-427
DOE/ER/53214–					
3	17:8228	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005087	MF-426
DOE/ER/53218–					
17	17:8229	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91019077	MF-427
18	17:8230	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91019078	MF-427
19	17:8231	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91019082	MF-427
DOE/ER/53222–					
106	17:8330	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003987	PC-426
DOE/ER/53264–					
1	17:8331	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004396	MF-420
DOE/ER/53269–					
4	17:8232	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004489	MF-427
DOE/ER/60406–					
T5	17:7637	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003461	MF-408
DOE/ER/60409–					
6	17:7684	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004451	MF-408
DOE/ER/60429–					
T1	17:7745	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003766	MF-408
DOE/ER/60437–					
6	17:7633	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004693	MF-410
DOE/ER/60455–					
5	17:7102	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91019079	MF-408
6	17:7103	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91019080	MF-408

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
DOE/ER/60504–					
T1	17:8140	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003761	MF-411
DOE/ER/60507–					
5	17:7746	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004029	MF-408
DOE/ER/60574–					
T1	17:7818	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004303	MF-403
DOE/ER/60639–					
4	17:7648	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004065	MF-408
DOE/ER/60642–					
4	17:7501	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004052	MF-404
DOE/ER/60648–					
4	17:7045	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004416	MF-401
DOE/ER/60656–					
5	17:7685	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003421	MF-408
DOE/ER/60820–					
2	17:7572	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004685	MF-403
DOE/ER/60845–					
2	17:7573	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004390	MF-402
DOE/ER/60914–					
T1	17:7747	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003764	MF-408
DOE/ER/60925–					
T1	17:7482	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003752	MF-408
DOE/ER/60946–					
2	17:7574	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004040	MF-402
DOE/ER/60989–					
2	17:7682	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004421	MF-408
DOE/ER/61085–					
1	17:7483	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004016	MF-408
DOE/ER/61171–					
T1	17:7748	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004436	MF-408
DOE/ER/75564–					
7	17:6910	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005086	MF-404
DOE/ET/10815–					
171	17:6221	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004039	MF-112
DOE/ET/53088–					
519	17:8233	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004646	MF-427
524	17:8234	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004248	MF-426
525	17:8235	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004251	MF-426
526	17:8236	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004249	MF-420
527	17:8237	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004252	MF-427
531	17:8238	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004250	MF-426
DOE/EV/00119–					
264	17:7749	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004081	MF-408
DOE/EV/10095–					
T2	17:7750	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003069	MF-707
DOE/EV/10277–					
T2	17:7802	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004101	MF-408
DOE/ID–					
10237(90-91)	17:6507	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003316	MF-225
DOE/ID/12489–					
116	17:6541	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004818	MF-250
DOE/ID/13074–					
T1	17:6878	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004326	MF-333
DOE/MC/11076–					
3017	17:6162	OSTI; NTIS; GPO Dep.	E 1.99:	DE91002097	MF-109
3019	17:6318	OSTI; NTIS; GPO Dep.	E 1.99:	DE91016652	MF-123
DOE/MC/22012–					
3003	17:6267	OSTI; NTIS; GPO Dep.	E 1.99:	DE91002083	MF-103
DOE/MC/24164–					
3012	17:6837	OSTI; NTIS; GPO Dep.	E 1.99:	DE91002092	MF-110
DOE/MC/24248–					
3015	17:6163	OSTI; NTIS; GPO Dep.	E 1.99:	DE91002095	MF-109; MF-113
DOE/MC/25006–					
3011	17:6164	OSTI; NTIS; GPO Dep.	E 1.99:	DE91002090	PC-106
DOE/MC/25124–					
3014	17:6875	OSTI; NTIS; GPO Dep.	E 1.99:	DE91002094	PC-111
DOE/MC/25137–					
2999	17:6268	OSTI; NTIS; GPO Dep.	E 1.99:	DE91002081	PC-103
DOE/MC/26044–					
T28	17:6876	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003473	MF-111

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
DOE/MI/10150–					
T1	17:6775	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005260	MF-900
DOE/NE/37963–					
17	17:6911	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004394	MF-504
18	17:6912	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004392	MF-504; MF-520
19	17:6913	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004399	MF-504
20	17:6914	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004400	MF-504
DOE/NE/37967–					
T7	17:7149	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004944	MF-520
DOE/NE/37969–					
3	17:7150	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004760	MF-520
DOE/NS–					
0002P	17:6329	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002946	MF-940
0005P	17:6712	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004953	MF-940
DOE/NV/10384–					
65	17:6776	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004831	MF-702
T1	17:6777	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004243	MF-700
DOE/NV/10630–					
20-Vol.2	17:7546	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92000107	MF-702
DOE/NV/10845–					
12	17:8385	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004123	MF-702
66	17:6778	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004832	MF-702
DOE/OR/00033–					
T448	17:6803	OSTI; NTIS; GPO Dep.	E 1.99:	DE91014924	MF-900
T453	17:7686	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004748	MF-407
T455	17:7807	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004750	MF-407
T456	17:7575	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004764	MF-402
T457	17:7576	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004765	MF-402
T459	17:7683	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004767	MF-408
T460	17:6915	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004768	MF-332
T461	17:7803	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004769	MF-408
T462	17:8123	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004770	MF-400
T464	17:7415	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004538	MF-406
DOE/OR/03054–					
120	17:6107	OSTI; NTIS (documentation only); ESTSC (complete software package), P.O. Box 1020, Oak Ridge, TN 37831-1020; GPO Dep.	E 1.99:	DE92005192	MF-108
DOE/OR/21548–					
194	17:7577	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92001850	MF-511
224	17:7615	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92001946	MF-511
DOE/OSTI–					
3409/2	17:6859	OSTI; NTIS; GPO Dep.	E 1.99:	DE92000497	PC-310
DOE/PC/79651–					
T2	17:6269	OSTI; NTIS; GPO Dep.	E 1.99:	DE92000456	PC-113
DOE/PC/79679–					
T1	17:6834	OSTI; NTIS; GPO Dep.	E 1.99:	DE92000036	PC-112
DOE/PC/79816–					
8	17:6165	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004500	MF-108
DOE/PC/79850–					
6	17:6270	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005208	MF-105
7	17:6271	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005209	MF-105
8	17:6272	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005210	MF-105
9	17:6273	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005211	MF-105
10	17:6274	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005212	MF-105
DOE/PC/79861–					
T1	17:6242	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004309	MF-105
DOE/PC/79865–					
T1-Vol.3	17:6108	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92001740	PC-102
DOE/PC/79925–					
T1	17:6222	OSTI; NTIS; GPO Dep.	E 1.99:	DE92000037	PC-113
DOE/PC/79929–					
13	17:6223	OSTI; NTIS; GPO Dep.	E 1.99:	DE91018978	PC-104
DOE/PC/81010–					
T1	17:6243	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004183	MF-105
DOE/PC/88652–					
T7	17:6835	OSTI; NTIS; GPO Dep.	E 1.99:	DE92002134	PC-115
DOE/PC/88654–					
T3	17:6275	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004870	MF-102
DOE/PC/88697–					
T4	17:6276	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004583	MF-104

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DOE/PC/88802–					
T7	17:6166	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003087	MF-108
T8	17:6167	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004846	MF-108
DOE/PC/88818–					
10	17:6168	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004520	MF-108
DOE/PC/88850–					
T5	17:6244	OSTI; NTIS; GPO Dep.	E 1.99:	DE92002584	PC-105
DOE/PC/88852–					
T3-Rev.1	17:6566	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001791	PC-105; PC-114
T4	17:6245	OSTI; NTIS; GPO Dep.	E 1.99:	DE92002583	PC-105; PC-114
DOE/PC/88868–					
T6	17:6567	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003088	MF-105
DOE/PC/88921–					
8	17:6224	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004498	MF-102
DOE/PC/88924–					
13	17:6225	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005350	PC-113
DOE/PC/88925–					
T8	17:6109	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005137	MF-113
DOE/PC/88927–					
12	17:6169	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004184	PC-106
DOE/PC/88935–					
T9	17:6170	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005141	MF-108
DOE/PC/88939–					
14	17:6226	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004524	MF-102
DOE/PC/89651–					
T2	17:6277	OSTI; NTIS; GPO Dep.	E 1.99:	DE92002133	PC-105
DOE/PC/89659–					
2	17:6278	OSTI; NTIS; GPO Dep.	E 1.99:	DE92000029	PC-104
DOE/PC/89770–					
T3	17:6171	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005198	MF-102
DOE/PC/89775–					
6	17:6172	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003082	MF-102
DOE/PC/89776–					
T5	17:6279	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004499	MF-104
DOE/PC/89781–					
8	17:6173	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004521	MF-102
DOE/PC/89785–					
8	17:6227	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004525	MF-113
DOE/PC/89787–					
T2	17:6174	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004873	MF-125
DOE/PC/89790–					
8	17:6175	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004523	MF-105
DOE/PC/89878–					
T6	17:6176	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004871	MF-102
DOE/PC/89883–					
27	17:6177	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004518	MF-108
DOE/PC/90005–					
T51	17:6178	OSTI; NTIS; GPO Dep.	E 1.99:	DE92000280	PC-108
T53	17:6179	OSTI; NTIS; GPO Dep.	E 1.99:	DE92000279	PC-108
T54	17:6180	OSTI; NTIS; GPO Dep.	E 1.99:	DE92002585	PC-108
DOE/PC/90044–					
4	17:6181	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004519	MF-109
DOE/PC/90160–					
T3	17:6559	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004875	MF-113
DOE/PC/90167–					
T3	17:6110	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004968	MF-102
T4	17:6111	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004847	MF-102
DOE/PC/90176–					
T49	17:6112	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004185	MF-102
T50	17:6182	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004186	MF-105
T51	17:6183	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004187	MF-102
T52	17:6184	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004188	MF-102
T53	17:6185	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004189	MF-102
T54	17:6280	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004190	MF-105
T55	17:6228	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004191	MF-105
T56	17:6186	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004192	MF-105; ND-102
T57	17:6113	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004193	MF-105; MF-102

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T58	17:6187	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004194	MF-102
T59	17:6114	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004195	MF-107; MF-105
T60	17:6188	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004196	MF-105
T61	17:6115	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004197	MF-105
T62	17:6116	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004198	MF-102
T63	17:6189	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004199	MF-105
T64	17:6117	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004071	MF-105
DOE/PC/90177–					
T5	17:6118	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005197	MF-102
DOE/PC/90178–					
T4	17:6119	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004910	MF-113
DOE/PC/90275–					
T18	17:6281	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004972	MF-104
DOE/PC/90284–					
5	17:6229	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004517	MF-113
DOE/PC/90295–					
T3	17:6120	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005140	MF-102
DOE/PC/90523–					
11	17:6190	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004325	MF-108
T8	17:6191	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001656	PC-108
T9	17:6192	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004322	MF-108
DOE/PC/90544–					
T1	17:6246	OSTI; NTIS; GPO Dep.	E 1.99:	DE92002828	MF-105
DOE/PC/91026–					
T2	17:6193	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004911	MF-108
DOE/RL–					
90-24-Vol.1-Rev.1	17:6334	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004155	MF-630; MF-721
90-32-Rev.1	17:6453	OSTI; NTIS; GPO Dep.	E 1.99:	DE92002044	MF-600
90-37-Rev.1	17:6456	OSTI; NTIS; GPO Dep.	E 1.99:	DE92002045	MF-600
91-44	17:7616	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002916	MF-630
DOE/RL/12253–					
T3	17:6378	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003489	MF-900
DOE/RW–					
0006-Rev.7	17:6366	INIS; OSTI (Free of Charge)		TI92003986	MF-810
0307P-4	17:6379	OSTI (Free of Charge); INIS		TI92000352	MF-814
DOE/SF/16306–					
31	17:6536	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004644	MF-231
DOE/SF/17124–					
T1	17:7535	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92004335	MF-706
DUH–					
10548	17:6663	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92002849	MF-702
ECN-C–					
90-057	17:6380	OSTI; NTIS (US Sales Only); INIS		DE92613946	
90-063	17:6381	OSTI; NTIS (US Sales Only); INIS		DE92613948	
91-003	17:6382	OSTI; NTIS (US Sales Only); INIS		DE92613949	
91-006	17:6675	OSTI; NTIS (US Sales Only); INIS		DE92613836	
91-018	17:8332	OSTI; NTIS (US Sales Only); INIS		DE92614526	
91-040	17:6676	OSTI; NTIS (US Sales Only); INIS		DE92613837	
ECN-RX–					
91-005	17:7079	OSTI; NTIS (US Sales Only); INIS		DE92613385	
91-017	17:6383	OSTI; NTIS (US Sales Only); INIS		DE92613952	
91-059	17:8174	OSTI; NTIS (US Sales Only); INIS		DE92614536	
EGG–					
10617-1080	17:7578	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003606	MF-702
10617-1132	17:7579	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004702	MF-702
10617-2080	17:7643	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92004459	
10617-2093	17:6783	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004366	MF-630
10617-2103	17:7416	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003688	MF-706
10617-5093	17:8145	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003690	MF-706
2630	17:6745	*See* NUREG/CR–5520			
2663	17:6655	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004797	PC-705
EGG-EP–					
9766	17:6767	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003331	MF-333
9839	17:6545	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003361	MF-257
EGG-M–					
91053	17:6630	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003300	
91216	17:6713	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003321	
91314	17:6860	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003286	
91315	17:6861	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003285	

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91370	17:6714	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003324	
91428	17:6606	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92003320	MF-528
91482	17:6793	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003317	MF-528
91483	17:6797	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003325	MF-500
91485	17:6607	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003287	MF-528
91489	17:6715	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003322	
91501	17:6716	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003308	
EGG-WTD–					
9776-Rev.1	17:6384	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003336	MF-902
9899	17:6457	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003264	MF-702
9935	17:7104	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003302	MF-940
EML–					
542	17:7547	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004856	MF-402
543	17:7548	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004855	MF-402
ENEA-RT-AMB–					
90-35	17:6862	OSTI; NTIS (US Sales Only)		DE92743979	
90-47	17:7484	OSTI; NTIS (US Sales Only)		DE92744022	
ENEA-RT-INN–					
90-17	17:7201	OSTI; NTIS (US Sales Only)		DE92744021	
90-32	17:7260	OSTI; NTIS (US Sales Only)		DE92744018	
90-36	17:7202	OSTI; NTIS (US Sales Only)		DE92744007	
90-38	17:7203	OSTI; NTIS (US Sales Only)		DE92744019	
90-49	17:7261	OSTI; NTIS (US Sales Only)		DE92744016	
90-50	17:7262	OSTI; NTIS (US Sales Only)		DE92744011	
90-51	17:7204	OSTI; NTIS (US Sales Only)		DE92743980	
90-52	17:7485	OSTI; NTIS (US Sales Only)		DE92744023	
90-54	17:7263	OSTI; NTIS (US Sales Only)		DE92744012	
90-55	17:7205	OSTI; NTIS (US Sales Only)		DE92743978	
90-56	17:6974	OSTI; NTIS (US Sales Only)		DE92744020	
90-57	17:7206	OSTI; NTIS (US Sales Only)		DE92744014	
90-58	17:7207	OSTI; NTIS (US Sales Only)		DE92744010	
90-59	17:7208	OSTI; NTIS (US Sales Only)		DE92744002	
90-60	17:7264	OSTI; NTIS (US Sales Only)		DE92744006	
90-66	17:7209	OSTI; NTIS (US Sales Only)		DE92744024	
90-68	17:7265	OSTI; NTIS (US Sales Only)		DE92744013	
90-70	17:7266	OSTI; NTIS (US Sales Only)		DE92744017	
90-71	17:7210	OSTI; NTIS (US Sales Only)		DE92744005	
90-72	17:7267	OSTI; NTIS (US Sales Only)		DE92744015	
ENEA-RT-NUCL–					
90-04	17:8239	OSTI; NTIS (US Sales Only)		DE92743986	
90-13	17:8252	OSTI; NTIS (US Sales Only)		DE92744004	
90-15	17:8334	OSTI; NTIS (US Sales Only)		DE92743981	
90-22	17:7549	OSTI; NTIS (US Sales Only)		DE92743982	
90-24	17:6469	OSTI; NTIS (US Sales Only)		DE92744028	
90-26	17:6916	OSTI; NTIS (US Sales Only)		DE92744031	
90-28	17:8335	OSTI; NTIS (US Sales Only)		DE92744032	
90-29	17:8253	OSTI; NTIS (US Sales Only)		DE92744033	
90-36	17:8336	OSTI; NTIS (US Sales Only)		DE92744003	
90-37	17:8254	OSTI; NTIS (US Sales Only)		DE92744009	
90-39	17:8255	OSTI; NTIS (US Sales Only)		DE92744027	
90-40	17:8256	OSTI; NTIS (US Sales Only)		DE92744001	
90-41	17:8337	OSTI; NTIS (US Sales Only)		DE92744008	
90-44	17:8338	OSTI; NTIS (US Sales Only)		DE92744030	
90-46	17:7002	OSTI; NTIS (US Sales Only)		DE92744026	
90-47	17:6975	OSTI; NTIS (US Sales Only)		DE92744025	
90-48	17:8339	OSTI; NTIS (US Sales Only)		DE92744029	
ENET–					
8900340/1	17:6588	OSTI; NTIS (US Sales Only); ENET, Elfenauweg 29, CH-3006 Bern (CH)		DE92613830	
ES/CSET–					
11	17:7151	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003962	MF-630
ES/ER/TM–					
7	17:6458	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003714	MF-902
19	17:6784	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003747	MF-902
ESG–					
133	17:7282	*See* LBL–30674			
ESG-DOE–					
13276	17:6335	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004037	PC-533
13277	17:6336	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004038	MF-533
ESL–					
91001-FR	17:6541	*See* DOE/ID/12489–116			

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
ETDE-IT–					
91-83	17:7580	OSTI; NTIS (US Sales Only)		DE92744000	
ETDE-mf–					
2750133	17:6838	OSTI; NTIS (US Sales Only)		DE92750133	
2750173	17:6560	OSTI; NTIS (US Sales Only)		DE92750173	
2750197	17:7804	OSTI; NTIS (US Sales Only)		DE92750197	
2750311	17:6288	OSTI; NTIS (US Sales Only)		DE92750311	
2758979	17:6877	OSTI; NTIS (US Sales Only)		DE92758979	
ETDE/JP-mf–					
2749179	17:6250	OSTI; NTIS (US Sales Only)		DE92749179	
2749180	17:6251	OSTI; NTIS (US Sales Only)		DE92749180	
2749181	17:6290	OSTI; NTIS (US Sales Only)		DE92749181	
2749182	17:6291	OSTI; NTIS (US Sales Only)		DE92749182	
2749183	17:6252	OSTI; NTIS (US Sales Only)		DE92749183	
2749184	17:6253	OSTI; NTIS (US Sales Only)		DE92749184	
ETSU-S–					
1197F	17:6537	OSTI; NTIS (US Sales Only)		DE92750023	
EUR–					
13268(V.1)	17:7751	OSTI; NTIS (US Sales Only); INIS		TI92613602	
13268(V.2)	17:7752	OSTI; NTIS (US Sales Only); INIS		TI92613603	
13268(V.3)	17:7753	OSTI; NTIS (US Sales Only); INIS		TI92613604	
13387	17:7754	OSTI; NTIS (US Sales Only); INIS		TI92613535	
13434	17:6454	OSTI; NTIS (US Sales Only)		TI92743499	
13438	17:6717	OSTI; NTIS (US Sales Only)		TI92743651	
13489	17:6601	OSTI; NTIS (US Sales Only)		TI92743653	
13588	17:7180	OSTI; NTIS (US Sales Only)		TI92743649	
EUR-ICP-CEH–					
093(S)	17:7755	OSTI; NTIS (US Sales Only); INIS		TI92614984	
FASAC-TAR–					
92003807	17:6627	OSTI; Science Applications International Corp., 1710 Goodridge Dr., P.O. Box 1303, McLean, VA 22102		TI92003807	
FNAL-TM–					
1726	17:7312	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003885	PC-414
1728	17:7313	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004676	PC-414
1757	17:8198	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003339	PC-406
1761	17:7314	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003899	PC-414
1765	17:7426	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004754	PC-414
1766	17:7427	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92006750	PC-414
FNAL/C–					
91-316	17:7422	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004807	MF-406
91/204	17:7305	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005109	MF-414
91/205	17:7417	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004804	MF-414
91/218	17:7306	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005108	MF-414
91/246	17:7307	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004531	MF-414
91/254	17:7308	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004530	MF-414
91/255	17:7309	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004529	MF-414
91/257	17:7310	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004528	MF-414
91/281	17:7917	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003054	MF-414
91/287-E	17:7945	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004117	MF-414
91/294-E	17:7976	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004803	MF-414
91/297	17:7418	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004120	MF-414; MF-406
91/300	17:7268	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004122	MF-414
91/302	17:7419	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004121	MF-414; MF-406
91/311	17:7311	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004118	MF-414
91/314	17:7420	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004806	MF-406
91/315	17:7421	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004809	MF-406
91/317	17:7423	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004119	MF-414; MF-406
91/319	17:7424	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004805	MF-406
91/320	17:7425	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004808	MF-406
91/325	17:8065	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005332	MF-414
91/328	17:7946	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005110	MF-414
FNAL/Pub–					
91/330	17:7369	*See* SSCL-Preprint–6			
FR–					
10107	17:7535	*See* DOE/SF/17124–T1			
FhG-IWM-W–					
5/90	17:7190	OSTI; NTIS (US Sales Only); INIS		DE92758983	

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GA-A–					
20570	17:8340	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004296	MF-420
20587	17:8341	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004295	MF-422
20607	17:8342	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004288	MF-426
20610	17:8257	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004456	MF-420
20617	17:8343	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005437	MF-420
20619	17:8258	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004294	MF-422
20632	17:8344	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004293	MF-421
20636	17:8345	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004044	MF-427
20717	17:6656	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002311	MF-522
20750	17:8346	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004457	MF-420
GRS-F-BL–					
2/1991	17:6718	OSTI; NTIS (US Sales Only); INIS		DE92750163	
GSF–					
41/90	17:7581	OSTI; NTIS (US Sales Only); INIS		DE92750155	
GSI–					
90-02	17:7868	OSTI; NTIS (US Sales Only); INIS		DE92750132	
91-17	17:7756	OSTI; NTIS (US Sales Only); INIS		DE92750162	
91-56(prepr.)	17:8146	OSTI; NTIS (US Sales Only); INIS		DE92759313	
HAN–					
18510	17:6455	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92004545	MF-702
29905	17:6677	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92006560	MF-520
42598-Del.	17:6330	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92003707	MF-700
78124-Del.	17:6687	*See* HW–68718-Del.			
HW–					
10488	17:6341	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92005504	MF-711
30852	17:6680	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92003044	MF-702
31005	17:6342	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92004552	MF-711
31417	17:6343	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92004553	MF-711
31514	17:6344	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92004554	MF-711
32056	17:6345	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92004555	MF-711
32630-Del.	17:6719	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92003721	MF-500
34216	17:6346	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92004977	MF-711
34847-Pt.14	17:6720	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92001735	MF-520
35445	17:6347	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92004557	MF-711
46104	17:6459	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92002891	MF-707
49419-C-Del.	17:6331	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92002845	MF-700
50241	17:6348	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92003505	MF-510
50266-RD-Del.	17:6332	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92004558	MF-711
51970	17:6681	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92002874	MF-520
54005	17:6349	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92004559	MF-700
55014-RD	17:6350	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92004560	MF-711
55176-Pt.3	17:6385	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE91018783	MF-721
55455	17:6351	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92004561	MF-711
56230-RD	17:6682	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92002875	MF-700
58265-RD	17:6683	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92002884	MF-520
60143	17:6352	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92004562	MF-711
60157	17:6684	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92002886	MF-520
62585	17:6685	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92002893	MF-500
63996	17:6721	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92002887	MF-700
66468	17:6686	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92002888	MF-520
68718-Del.	17:6687	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92001667	MF-500
7-3689	17:6678	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92004546	MF-700
7-3789	17:6679	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92004547	MF-700
7-5538-Del.	17:6337	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92004548	MF-700
7-5708-Del.	17:6338	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92004550	MF-700
7-5821-Del.	17:6339	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92004549	MF-700
7-5853-Del.	17:6340	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92004551	MF-700
78458	17:6664	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92002847	MF-520
89083	17:6353	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92004563	MF-711
HW-SA–					
2016	17:6688	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92003509	MF-702
3547	17:6665	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92002841	MF-520
IAE–					
0079.	17:8053	*See* CNIC–00421			
0080.	17:8054	*See* CNIC–00423			
0081.	17:7038	*See* CNIC–00436			
0083.	17:7039	*See* CNIC–00442			
0085.	17:7040	*See* CNIC–00452			
IAEA-INFCIRC–					
207(Add.2)	17:6481	OSTI; NTIS (US Sales Only); INIS		DE92615174	

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395	17:6881	OSTI; NTIS (US Sales Only); INIS		DE92614093	
396	17:6470	OSTI; NTIS (US Sales Only); INIS		DE92615192	
397	17:8450	OSTI; NTIS (US Sales Only); INIS		DE92615181	
IAEA-R–					
4273-F	17:6471	OSTI; NTIS (US Sales Only); INIS		DE92615187	
5060-F	17:7582	OSTI; NTIS (US Sales Only); INIS		DE92613458	
5234-F	17:8066	OSTI; NTIS (US Sales Only); INIS		DE92615322	
IAEA-TECDOC–					
613	17:7649	OSTI; NTIS (US Sales Only); INIS		DE92613626	
619	17:7428	OSTI; NTIS (US Sales Only); INIS		DE92615125	
621	17:6569	OSTI; NTIS (US Sales Only); INIS		DE92615098	
627	17:6570	OSTI; NTIS (US Sales Only); INIS		DE92615099	
628	17:7191	OSTI; NTIS (US Sales Only); INIS		DE92615082	
628/S	17:7192	OSTI; NTIS (US Sales Only); INIS		DE92615083	
629	17:6386	OSTI; NTIS (US Sales Only); INIS		DE92615145	
632	17:6571	OSTI; NTIS (US Sales Only); INIS		DE92615100	
IAEA-TSRA–					
1	17:8386	OSTI; NTIS (US Sales Only); INIS		DE92614117	
IASSNS-HEP–					
91/69	17:7894	*See* LBL–31325			
IC–					
90/239	17:6785	OSTI; NTIS (US Sales Only); INIS		DE92613622	
90/323	17:7843	OSTI; NTIS (US Sales Only); INIS		DE92614139	
90/324	17:7844	OSTI; NTIS (US Sales Only); INIS		DE92614140	
90/328	17:6538	OSTI; NTIS (US Sales Only); INIS		DE92613775	
90/356	17:7845	OSTI; NTIS (US Sales Only); INIS		DE92614141	
90/458	17:7846	OSTI; NTIS (US Sales Only); INIS		DE92614142	
91/102	17:7947	OSTI; NTIS (US Sales Only); INIS		DE92609732	
91/109	17:8280	OSTI; NTIS (US Sales Only); INIS		DE92609543	
91/114	17:7876	OSTI; NTIS (US Sales Only); INIS		DE92609741	
91/121	17:8281	OSTI; NTIS (US Sales Only); INIS		DE92609544	
91/124	17:7877	OSTI; NTIS (US Sales Only); INIS		DE92609090	
91/128	17:7948	OSTI; NTIS (US Sales Only); INIS		DE92609742	
91/129	17:8118	OSTI; NTIS (US Sales Only); INIS		DE92609934	
91/130	17:8067	OSTI; NTIS (US Sales Only); INIS		DE92614353	
91/133	17:7949	OSTI; NTIS (US Sales Only); INIS		DE92609712	
91/134	17:7977	OSTI; NTIS (US Sales Only); INIS		DE92609743	
91/140	17:7978	OSTI; NTIS (US Sales Only); INIS		DE92609744	
91/147	17:7878	OSTI; NTIS (US Sales Only); INIS		DE92609094	
91/152	17:7918	OSTI; NTIS (US Sales Only); INIS		DE92609862	
91/157	17:7879	OSTI; NTIS (US Sales Only); INIS		DE92609771	
91/161	17:7979	OSTI; NTIS (US Sales Only); INIS		DE92615300	
91/166	17:8068	OSTI; NTIS (US Sales Only); INIS		DE92614345	
91/167	17:8046	OSTI; NTIS (US Sales Only); INIS		DE92614308	
91/172	17:8184	OSTI; NTIS (US Sales Only); INIS		DE92614558	
91/177	17:8282	OSTI; NTIS (US Sales Only); INIS		DE92614464	
91/178	17:8283	OSTI; NTIS (US Sales Only); INIS		DE92614465	
91/179	17:8161	OSTI; NTIS (US Sales Only); INIS		DE92615480	
91/182	17:8284	OSTI; NTIS (US Sales Only); INIS		DE92614466	
91/190	17:7848	OSTI; NTIS (US Sales Only); INIS		DE92615228	
91/191	17:8162	OSTI; NTIS (US Sales Only); INIS		DE92615481	
91/194	17:7849	OSTI; NTIS (US Sales Only); INIS		DE92615229	
91/204	17:7880	OSTI; NTIS (US Sales Only); INIS		DE92614147	
91/217	17:8199	OSTI; NTIS (US Sales Only); INIS		DE92614571	
91/224	17:8163	OSTI; NTIS (US Sales Only); INIS		DE92615482	
91/225	17:7850	OSTI; NTIS (US Sales Only); INIS		DE92615230	
91/236	17:7851	OSTI; NTIS (US Sales Only); INIS		DE92615231	
91/237	17:7852	OSTI; NTIS (US Sales Only); INIS		DE92615232	
91/238	17:7881	OSTI; NTIS (US Sales Only); INIS		DE92615238	
91/240	17:8141	OSTI; NTIS (US Sales Only); INIS		DE92615394	
91/242	17:8164	OSTI; NTIS (US Sales Only); INIS		DE92615483	
91/243	17:7882	OSTI; NTIS (US Sales Only); INIS		DE92615258	
91/244	17:7853	OSTI; NTIS (US Sales Only); INIS		DE92615233	
91/245	17:7854	OSTI; NTIS (US Sales Only); INIS		DE92615234	
91/246	17:8165	OSTI; NTIS (US Sales Only); INIS		DE92615484	
91/247	17:8166	OSTI; NTIS (US Sales Only); INIS		DE92615485	
91/248	17:7827	OSTI; NTIS (US Sales Only); INIS		DE92614127	
91/249	17:7080	OSTI; NTIS (US Sales Only); INIS		DE92613323	
91/258	17:7828	OSTI; NTIS (US Sales Only); INIS		DE92615214	
91/261	17:7883	OSTI; NTIS (US Sales Only); INIS		DE92615259	
91/262	17:7884	OSTI; NTIS (US Sales Only); INIS		DE92615260	

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91/263	17:7885	OSTI; NTIS (US Sales Only); INIS		DE92615261	
91/265	17:7829	OSTI; NTIS (US Sales Only); INIS		DE92615215	
91/266	17:7830	OSTI; NTIS (US Sales Only); INIS		DE92615216	
91/267	17:7855	OSTI; NTIS (US Sales Only); INIS		DE92614143	
91/268	17:7919	OSTI; NTIS (US Sales Only); INIS		DE92614197	
91/269	17:8134	OSTI; NTIS (US Sales Only); INIS		DE92614416	
91/270	17:7856	OSTI; NTIS (US Sales Only); INIS		DE92615235	
91/272	17:7831	OSTI; NTIS (US Sales Only); INIS		DE92615217	
91/273	17:7832	OSTI; NTIS (US Sales Only); INIS		DE92615218	
91/274	17:7833	OSTI; NTIS (US Sales Only); INIS		DE92614128	
91/276	17:8167	OSTI; NTIS (US Sales Only); INIS		DE92615486	
91/277	17:8179	OSTI; NTIS (US Sales Only); INIS		DE92615517	
91/278	17:7834	OSTI; NTIS (US Sales Only); INIS		DE92615219	
91/280	17:8175	OSTI; NTIS (US Sales Only); INIS		DE92615488	
91/283	17:8168	OSTI; NTIS (US Sales Only); INIS		DE92615487	
91/285	17:7857	OSTI; NTIS (US Sales Only); INIS		DE92614144	
91/286	17:8169	OSTI; NTIS (US Sales Only); INIS		DE92614534	
91/288	17:8176	OSTI; NTIS (US Sales Only); INIS		DE92615489	
91/29	17:8007	OSTI; NTIS (US Sales Only); INIS		DE92615304	
91/290	17:7920	OSTI; NTIS (US Sales Only); INIS		DE92614198	
91/291	17:7980	OSTI; NTIS (US Sales Only); INIS		DE92615301	
91/34	17:8279	OSTI; NTIS (US Sales Only); INIS		DE92615435	
91/60	17:7847	OSTI; NTIS (US Sales Only); INIS		DE92615236	
IEE-SR–					
223	17:6825	OSTI; NTIS (US Sales Only)		DE92749185	
IFP–					
37-606	17:6293	OSTI; NTIS (US Sales Only)		DE92733713	
37891	17:6299	OSTI; NTIS (US Sales Only)		DE92733710	
IFSR–					
519	17:8233	*See* DOE/ET/53088–519			
524	17:8234	*See* DOE/ET/53088–524			
525	17:8235	*See* DOE/ET/53088–525			
526	17:8236	*See* DOE/ET/53088–526			
527	17:8237	*See* DOE/ET/53088–527			
531	17:8238	*See* DOE/ET/53088–531			
IKE–					
4-133	17:8397	OSTI; NTIS (US Sales Only); INIS		DE92750140	
IM–					
2619	17:7195	*See* STU-I–773-1990			
2646	17:7196	*See* STU-I–774-1990			
2699.	17:7196	*See* STU-I–774-1990			
2705	17:7195	*See* STU-I–773-1990			
2706.	17:7195	*See* STU-I–773-1990			
INCT–					
2070-2073/IChTJ/D/A,B-V.1,2	17:6485	OSTI; NTIS (US Sales Only); INIS		DE92613704	
2070-2073/IChTJ/D/A,B-V.1,2	17:6488	OSTI; NTIS (US Sales Only); INIS		DE92613705	
INDC(AUS)–					
014/L	17:8069	OSTI; NTIS (US Sales Only); INIS		DE92615323	
INDC(BZL)–					
034/L	17:8070	OSTI; NTIS (US Sales Only); INIS		DE92615324	
INDC(CCP)–					
316/L	17:8071	OSTI; NTIS (US Sales Only); INIS		DE92615325	
338/L	17:8042	OSTI; NTIS (US Sales Only); INIS		DE92615309	
341/LP	17:8072	OSTI; NTIS (US Sales Only); INIS		DE92615385	
342/L	17:8073	OSTI; NTIS (US Sales Only); INIS		DE92615326	
343/L	17:8398	OSTI; NTIS (US Sales Only); INIS		DE92615195	
INDC(CPR)–					
023/L	17:8074	OSTI; NTIS (US Sales Only); INIS		DE92615327	
024/L	17:8075	OSTI; NTIS (US Sales Only); INIS		DE92615328	
INDC(EGY)–					
006/L	17:7429	OSTI; NTIS (US Sales Only); INIS		DE92615126	
INDC(HUN)–					
030/L	17:8091	OSTI; NTIS (US Sales Only); INIS		DE92615344	
INFN-TC–					
89-12	17:7315	OSTI; NTIS (US Sales Only); INIS		DE92612846	
INFO–					
0335	17:6689	OSTI; NTIS (US Sales Only); INIS		DE92613838	

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
INIS-BR–					
2848	17:7696	OSTI; NTIS (US Sales Only); INIS		DE92613552	
2849	17:7665	OSTI; NTIS (US Sales Only); INIS		DE92613668	
2850	17:7697	OSTI; NTIS (US Sales Only); INIS		DE92613593	
2851	17:7046	OSTI; NTIS (US Sales Only); INIS		DE92613318	
2852	17:6387	OSTI; NTIS (US Sales Only); INIS		DE92613934	
2853	17:7003	OSTI; NTIS (US Sales Only); INIS		DE92613450	
2854	17:6321	OSTI; NTIS (US Sales Only); INIS		DE92613469	
2855	17:7757	OSTI; NTIS (US Sales Only); INIS		DE92613525	
2856	17:7698	OSTI; NTIS (US Sales Only); INIS		DE92613553	
2857	17:7758	OSTI; NTIS (US Sales Only); INIS		DE92613526	
2858	17:7666	OSTI; NTIS (US Sales Only); INIS		DE92613669	
2859	17:7759	OSTI; NTIS (US Sales Only); INIS		DE92613530	
2860	17:7699	OSTI; NTIS (US Sales Only); INIS		DE92614950	
2861	17:7700	OSTI; NTIS (US Sales Only); INIS		DE92613554	
2862	17:7667	OSTI; NTIS (US Sales Only); INIS		DE92613670	
2863	17:7760	OSTI; NTIS (US Sales Only); INIS		DE92613611	
2864	17:8399	OSTI; NTIS (US Sales Only); INIS		DE92614100	
2865	17:8207	OSTI; NTIS (US Sales Only); INIS		DE92614431	
2866	17:6388	OSTI; NTIS (US Sales Only); INIS		DE92613956	
2868	17:6917	OSTI; NTIS (US Sales Only); INIS		DE92613395	
2869	17:7761	OSTI; NTIS (US Sales Only); INIS		DE92613609	
2870	17:6722	OSTI; NTIS (US Sales Only); INIS		DE92614964	
2871	17:8185	OSTI; NTIS (US Sales Only); INIS		DE92614559	
2872	17:6918	OSTI; NTIS (US Sales Only); INIS		DE92613401	
2873	17:6919	OSTI; NTIS (US Sales Only); INIS		DE92613396	
2874	17:6322	OSTI; NTIS (US Sales Only); INIS		DE92613470	
2875	17:7701	OSTI; NTIS (US Sales Only); INIS		DE92613565	
2876	17:8400	OSTI; NTIS (US Sales Only); INIS		DE92614104	
2877(V.1)	17:7702	OSTI; NTIS (US Sales Only); INIS		DE92613555	
2877(V.2)	17:7710	OSTI; NTIS (US Sales Only); INIS		DE92613561	
2878	17:6482	OSTI; NTIS (US Sales Only); INIS		DE92614089	
2879	17:6920	OSTI; NTIS (US Sales Only); INIS		DE92613397	
2880	17:6631	OSTI; NTIS (US Sales Only); INIS		DE92615087	
2881	17:8401	OSTI; NTIS (US Sales Only); INIS		DE92614101	
2882	17:7617	OSTI; NTIS (US Sales Only); INIS		DE92614883	
2883	17:7668	OSTI; NTIS (US Sales Only); INIS		DE92613627	
2886	17:7004	OSTI; NTIS (US Sales Only); INIS		DE92613447	
2887	17:7193	OSTI; NTIS (US Sales Only); INIS		DE92615084	
INIS-GB–					
374	17:6578	OSTI; NTIS (US Sales Only); INIS		DE92615105	
375	17:6579	OSTI; NTIS (US Sales Only); INIS		DE92615106	
376	17:6580	OSTI; NTIS (US Sales Only); INIS		DE92615107	
384	17:6723	OSTI; NTIS (US Sales Only); INIS		DE92614965	
385	17:6319	OSTI; NTIS (US Sales Only); INIS		DE92615027	
387	17:6483	OSTI; NTIS (US Sales Only); INIS		DE92615177	
388	17:7719	OSTI; NTIS (US Sales Only); INIS		DE92615178	
389	17:6611	OSTI; NTIS (US Sales Only); INIS		DE92615175	
INIS-XN–					
353	17:6484	OSTI; NTIS (US Sales Only); INIS		DE92615179	
INIS-mf–					
13025	17:7134	OSTI; NTIS (US Sales Only); INIS		DE92001334	
13040	17:6882	OSTI; NTIS (US Sales Only); INIS		DE92614094	
13041	17:6883	OSTI; NTIS (US Sales Only); INIS		DE92614095	
13043	17:6786	OSTI; NTIS (US Sales Only); INIS		DE92613623	
13044	17:6889	OSTI; NTIS (US Sales Only); INIS		DE92614096	
13045	17:6884	OSTI; NTIS (US Sales Only); INIS		DE92614097	
13046	17:6885	OSTI; NTIS (US Sales Only); INIS		DE92614098	
13047	17:7720	OSTI; NTIS (US Sales Only); INIS		DE92614951	
13048	17:7721	OSTI; NTIS (US Sales Only); INIS		DE92613572	
13049	17:7722	OSTI; NTIS (US Sales Only); INIS		DE92613573	
13050	17:7723	OSTI; NTIS (US Sales Only); INIS		DE92613574	
13051	17:7724	OSTI; NTIS (US Sales Only); INIS		DE92613575	
13052	17:7725	OSTI; NTIS (US Sales Only); INIS		DE92613576	
13053	17:7726	OSTI; NTIS (US Sales Only); INIS		DE92613577	
13054	17:7727	OSTI; NTIS (US Sales Only); INIS		DE92613578	
13055	17:7728	OSTI; NTIS (US Sales Only); INIS		DE92613579	
13056	17:7729	OSTI; NTIS (US Sales Only); INIS		DE92613580	
13057	17:7730	OSTI; NTIS (US Sales Only); INIS		DE92613581	
13058	17:6498	OSTI; NTIS (US Sales Only); INIS		DE92613601	
13059	17:7731	OSTI; NTIS (US Sales Only); INIS		DE92614091	

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13060	17:7732	OSTI; NTIS (US Sales Only); INIS		DE92613582	
13061	17:7733	OSTI; NTIS (US Sales Only); INIS		DE92613583	
13062	17:8350	OSTI; NTIS (US Sales Only); INIS		DE92615478	
13063	17:8351	OSTI; NTIS (US Sales Only); INIS		DE92615479	
13064	17:6323	OSTI; NTIS (US Sales Only); INIS		DE92613471	
13065	17:7050	OSTI; NTIS (US Sales Only); INIS		DE92614750	
13066	17:6572	OSTI; NTIS (US Sales Only); INIS		DE92613801	
13068	17:8148	OSTI; NTIS (US Sales Only); INIS		DE92614420	
13070	17:8285	OSTI; NTIS (US Sales Only); INIS		DE92614448	
13071	17:8187	OSTI; NTIS (US Sales Only); INIS		DE92614561	
13072	17:7673	OSTI; NTIS (US Sales Only); INIS		DE92613631	
13073	17:7958	OSTI; NTIS (US Sales Only); INIS		DE92614205	
13075	17:8286	OSTI; NTIS (US Sales Only); INIS		DE92614449	
13076	17:8287	OSTI; NTIS (US Sales Only); INIS		DE92614450	
13077	17:7674	OSTI; NTIS (US Sales Only); INIS		DE92613632	
13078	17:8108	OSTI; NTIS (US Sales Only); INIS		DE92614376	
13079	17:8154	OSTI; NTIS (US Sales Only); INIS		DE92614426	
13082	17:7083	OSTI; NTIS (US Sales Only); INIS		DE92614763	
13083	17:6886	OSTI; NTIS (US Sales Only); INIS		DE92615184	
13084	17:6887	OSTI; NTIS (US Sales Only); INIS		DE92615185	
13085	17:8352	OSTI; NTIS (US Sales Only); INIS		DE92615463	
13086	17:7773	OSTI; NTIS (US Sales Only); INIS		DE92614961	
13087	17:7619	OSTI; NTIS (US Sales Only); INIS		DE92614884	
13088	17:7620	OSTI; NTIS (US Sales Only); INIS		DE92614885	
13089	17:7621	OSTI; NTIS (US Sales Only); INIS		DE92614886	
13090	17:7622	OSTI; NTIS (US Sales Only); INIS		DE92614887	
14017	17:7474	OSTI; NTIS (US Sales Only); INIS		DE92750130	
14018	17:7675	OSTI; NTIS (US Sales Only); INIS		DE92758944	
INS–					
892	17:7241	OSTI; NTIS (US Sales Only); INIS		DE92751047	
INS-T–					
502	17:7238	OSTI; NTIS (US Sales Only); INIS		DE92751078	
503	17:8403	OSTI; NTIS (US Sales Only); INIS		DE92750967	
IPEN-PUB–					
337	17:8387	OSTI; NTIS (US Sales Only); INIS		DE92614118	
338	17:7140	OSTI; NTIS (US Sales Only); INIS		DE92613352	
340	17:7051	OSTI; NTIS (US Sales Only); INIS		DE92613308	
IPPT-IFTR–					
49/1988	17:8288	OSTI; NTIS (US Sales Only); INIS		DE92614467	
50/1988	17:8289	OSTI; NTIS (US Sales Only); INIS		DE92614468	
IS–					
5032	17:6121	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005173	MF-102
IS-M–					
672	17:6923	OSTI; NTIS; GPO Dep.	E 1.99:	DE92000524	MF-404
676	17:6924	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92004648	MF-528
IS-T–					
1540	17:7084	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005094	MF-401
1566	17:6925	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005095	MF-404
1577	17:8200	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005363	MF-410
1579	17:8193	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005091	MF-411
1584	17:8170	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005096	MF-410; MF-404
1587	17:6926	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005093	MF-404
1588	17:6927	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005364	MF-401
1589	17:8404	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005156	MF-405
1600	17:7085	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005154	MF-401
1601	17:6980	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005097	MF-401
1605	17:7052	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005153	MF-401
1617	17:7086	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005092	MF-401
ISAS–					
641	17:7551	OSTI; NTIS (US Sales Only); INIS		DE92750870	
ISPO–					
201	17:6697	*See* ORNL–6022			
336	17:6595	*See* LA–12191-M			
ITP-SB–					
91-49	17:7894	*See* LBL–31325			
JAERI-M–					
91-094	17:8353	OSTI; NTIS (US Sales Only); INIS		DE92750949	
91-103	17:6724	OSTI; NTIS (US Sales Only); INIS		DE92750950	
91-116	17:6928	OSTI; NTIS (US Sales Only); INIS		DE92750951	
91-118	17:7583	OSTI; NTIS (US Sales Only); INIS		DE92750952	

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91-119	17:8354	OSTI; NTIS (US Sales Only); INIS		DE92750953	
91-120	17:8355	OSTI; NTIS (US Sales Only); INIS		DE92750954	
91-121	17:8356	OSTI; NTIS (US Sales Only); INIS		DE92750955	
91-122	17:8357	OSTI; NTIS (US Sales Only); INIS		DE92750956	
91-123	17:8358	OSTI; NTIS (US Sales Only); INIS		DE92750957	
91-125	17:8359	OSTI; NTIS (US Sales Only); INIS		DE92750958	
91-126	17:8360	OSTI; NTIS (US Sales Only); INIS		DE92751036	
91-128	17:6725	OSTI; NTIS (US Sales Only); INIS		DE92750959	
91-130	17:6690	OSTI; NTIS (US Sales Only); INIS		DE92750960	
91-131	17:8290	OSTI; NTIS (US Sales Only); INIS		DE92750961	
91-132	17:6929	OSTI; NTIS (US Sales Only); INIS		DE92750962	
91-133	17:8361	OSTI; NTIS (US Sales Only); INIS		DE92751041	
91-134	17:7011	OSTI; NTIS (US Sales Only); INIS		DE92751046	
91-135	17:8291	OSTI; NTIS (US Sales Only); INIS		DE92750963	
91-136	17:6930	OSTI; NTIS (US Sales Only); INIS		DE92751006	
91-139	17:6691	OSTI; NTIS (US Sales Only); INIS		DE92751016	
91-141	17:7327	OSTI; NTIS (US Sales Only); INIS		DE92751037	
91-143	17:6581	OSTI; NTIS (US Sales Only); INIS		DE92750964	
91-144	17:6359	OSTI; NTIS (US Sales Only); INIS		DE92751027	
91-145	17:6360	OSTI; NTIS (US Sales Only); INIS		DE92751028	
91-155	17:7373	OSTI; NTIS (US Sales Only); INIS		DE92751045	
91-156	17:8292	OSTI; NTIS (US Sales Only); INIS		DE92751038	
91-159	17:8293	OSTI; NTIS (US Sales Only); INIS		DE92751039	
91-168	17:8362	OSTI; NTIS (US Sales Only); INIS		DE92751058	
91-180	17:8363	OSTI; NTIS (US Sales Only); INIS		DE92751040	
JHP–					
17	17:7328	OSTI; NTIS (US Sales Only); INIS		DE92751042	
18	17:7329	OSTI; NTIS (US Sales Only); INIS		DE92751043	
JINR-E–					
1-90-284	17:8037	OSTI; NTIS (US Sales Only); INIS		DE92609795	
2-90-196	17:7921	OSTI; NTIS (US Sales Only); INIS		DE92609713	
2-90-20	17:8119	OSTI; NTIS (US Sales Only); INIS		DE92609745	
2-90-24	17:7992	OSTI; NTIS (US Sales Only); INIS		DE92609746	
2-90-309	17:7886	OSTI; NTIS (US Sales Only); INIS		DE92609098	
2-90-354	17:7887	OSTI; NTIS (US Sales Only); INIS		DE92609099	
2-90-364	17:7888	OSTI; NTIS (US Sales Only); INIS		DE92609100	
2-90-383	17:7889	OSTI; NTIS (US Sales Only); INIS		DE92609101	
2-90-402	17:7890	OSTI; NTIS (US Sales Only); INIS		DE92609102	
2-90-414	17:7922	OSTI; NTIS (US Sales Only); INIS		DE92609747	
3-90-45	17:8045	OSTI; NTIS (US Sales Only); INIS		DE92609950	
JINR-R–					
1-90-149	17:8120	OSTI; NTIS (US Sales Only); INIS		DE92609956	
1-90-198	17:8121	OSTI; NTIS (US Sales Only); INIS		DE92609733	
10-90-335	17:7502	OSTI; NTIS (US Sales Only); INIS		DE92611157	
10-90-398	17:7503	OSTI; NTIS (US Sales Only); INIS		DE92611158	
13-90-400	17:7504	OSTI; NTIS (US Sales Only); INIS		DE92611159	
2-90-104	17:7891	OSTI; NTIS (US Sales Only); INIS		DE92609714	
4-90-404	17:7892	OSTI; NTIS (US Sales Only); INIS		DE92609103	
7-90-112	17:8109	OSTI; NTIS (US Sales Only); INIS		DE92609913	
Juel–					
2388	17:7552	OSTI; NTIS (US Sales Only)		DE92759209	
2420	17:7443	OSTI; NTIS (US Sales Only); INIS		DE92750199	
2435	17:8128	OSTI; NTIS (US Sales Only); INIS		DE92758892	
2440	17:7444	OSTI; NTIS (US Sales Only); INIS		DE92758893	
2449	17:8110	OSTI; NTIS (US Sales Only); INIS		DE92758895	
2450	17:6390	OSTI; NTIS (US Sales Only); INIS		DE92750128	
2453	17:8038	OSTI; NTIS (US Sales Only); INIS		DE92758894	
2455	17:7477	OSTI; NTIS (US Sales Only)		DE92758870	
2457	17:6501	OSTI; NTIS (US Sales Only)		DE92759210	
2469	17:7993	OSTI; NTIS (US Sales Only); INIS		DE92758891	
2474	17:7553	OSTI; NTIS (US Sales Only)		DE92750127	
2475	17:6981	OSTI; NTIS (US Sales Only); INIS		DE92758890	
2477	17:8111	OSTI; NTIS (US Sales Only); INIS		DE92758896	
2487	17:6982	OSTI; NTIS (US Sales Only)		DE92758988	
2495	17:6787	OSTI; NTIS (US Sales Only)		DE92759274	
2496	17:6294	OSTI; NTIS (US Sales Only)		DE92750124	
2497	17:6247	OSTI; NTIS (US Sales Only)		DE92750201	
2499	17:7271	OSTI; NTIS (US Sales Only); INIS		DE92758898	
2502	17:6592	OSTI; NTIS (US Sales Only); INIS		DE92750118	
2509	17:7676	OSTI; NTIS (US Sales Only); INIS		DE92750180	

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Juel-Spez–					
558	17:6391	OSTI; NTIS (US Sales Only); INIS		DE92750131	
K/CSD/TM–					
93-Rev.1	17:8441	OSTI; NTIS; GPO Dep.	E 1.99:	DE92000149	MF-505
95/Rev.1	17:8442	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004110	MF-505
K/ITP–					
415	17:6328	*See* NUREG/CR–5734			
K/TCD–					
1004	17:6397	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005098	MF-510
KAERI-II/RR–					
1/90	17:6392	OSTI; NTIS (US Sales Only); INIS		DE92615158	
11/90	17:7053	OSTI; NTIS (US Sales Only); INIS		DE92614572	
12/90	17:7141	OSTI; NTIS (US Sales Only); INIS		DE92614888	
13/90	17:6931	OSTI; NTIS (US Sales Only); INIS		DE92614822	
14/90	17:7087	OSTI; NTIS (US Sales Only); INIS		DE92614770	
15/90	17:6393	OSTI; NTIS (US Sales Only); INIS		DE92615147	
16/90	17:6394	OSTI; NTIS (US Sales Only); INIS		DE92615148	
22/90	17:6647	OSTI; NTIS (US Sales Only); INIS		DE92614813	
28/90	17:6363	OSTI; NTIS (US Sales Only); INIS		DE92615159	
5/90	17:7584	OSTI; NTIS (US Sales Only); INIS		DE92614882	
KAERI/RR–					
927/90	17:8201	OSTI; NTIS (US Sales Only); INIS		DE92615531	
934/90	17:8405	OSTI; NTIS (US Sales Only); INIS		DE92615196	
935/90	17:8406	OSTI; NTIS (US Sales Only); INIS		DE92615197	
937/90	17:7774	OSTI; NTIS (US Sales Only); INIS		DE92614972	
938/90	17:6648	OSTI; NTIS (US Sales Only); INIS		DE92615092	
939/90	17:6486	OSTI; NTIS (US Sales Only); INIS		DE92615024	
940/90	17:8202	OSTI; NTIS (US Sales Only); INIS		DE92615532	
942/90	17:6649	OSTI; NTIS (US Sales Only); INIS		DE92615093	
943/90	17:6794	OSTI; NTIS (US Sales Only); INIS		DE92615171	
945/90	17:6395	OSTI; NTIS (US Sales Only); INIS		DE92615149	
946/90	17:6582	OSTI; NTIS (US Sales Only); INIS		DE92615108	
947/90	17:6625	OSTI; NTIS (US Sales Only); INIS		DE92615166	
948/90	17:6657	OSTI; NTIS (US Sales Only); INIS		DE92615094	
949/90	17:6932	OSTI; NTIS (US Sales Only); INIS		DE92614823	
954/90	17:6726	OSTI; NTIS (US Sales Only); INIS		DE92615198	
957/90	17:8388	OSTI; NTIS (US Sales Only); INIS		DE92615201	
960/90	17:6641	OSTI; NTIS (US Sales Only); INIS		DE92615089	
961/90	17:6692	OSTI; NTIS (US Sales Only); INIS		DE92615115	
962/90	17:7623	OSTI; NTIS (US Sales Only); INIS		DE92614889	
964/90	17:6693	OSTI; NTIS (US Sales Only); INIS		DE92615116	
965/90	17:7129	OSTI; NTIS (US Sales Only); INIS		DE92614805	
966/90	17:6472	OSTI; NTIS (US Sales Only); INIS		DE92615186	
968/90	17:7194	OSTI; NTIS (US Sales Only); INIS		DE92615086	
970/90	17:6933	OSTI; NTIS (US Sales Only); INIS		DE92614824	
971/90	17:6642	OSTI; NTIS (US Sales Only); INIS		DE92615090	
972/90	17:7088	OSTI; NTIS (US Sales Only); INIS		DE92614764	
975/90	17:6626	OSTI; NTIS (US Sales Only); INIS		DE92615035	
976/90	17:7734	OSTI; NTIS (US Sales Only); INIS		DE92614952	
977/90	17:6983	OSTI; NTIS (US Sales Only); INIS		DE92614834	
978/90	17:6495	OSTI; NTIS (US Sales Only); INIS		DE92615038	
980/90	17:7181	OSTI; NTIS (US Sales Only); INIS		DE92615043	
982/90	17:6934	OSTI; NTIS (US Sales Only); INIS		DE92614815	
983/90	17:6694	OSTI; NTIS (US Sales Only); INIS		DE92615117	
984/90	17:6658	OSTI; NTIS (US Sales Only); INIS		DE92615095	
985/90	17:6496	OSTI; NTIS (US Sales Only); INIS		DE92615042	
KAPL–					
4731	17:8129	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003010	PC-505
KCP–					
613-4480	17:6984	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004794	PC-701
613-4506	17:7098	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004879	PC-701
613-4508	17:6935	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004882	PC-706
613-4528	17:6863	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004881	PC-705
613-4529	17:7153	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004793	PC-706
613-4530	17:6864	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004792	PC-706
613-4621	17:7154	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004880	PC-705
613-4643	17:7155	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003739	MF-706
KEK–					
91-3	17:8407	OSTI; NTIS (US Sales Only); INIS		DE92751022	
91-4	17:7354	OSTI; NTIS (US Sales Only); INIS		DE92751023	
91-5	17:7383	OSTI; NTIS (US Sales Only); INIS		DE92751024	

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
91-6	17:7355	OSTI; NTIS (US Sales Only); INIS		DE92751025	
91-7	17:7384	OSTI; NTIS (US Sales Only); INIS		DE92751026	
KEK-PROC–					
91-5	17:7446	OSTI; NTIS (US Sales Only); INIS		DE92751035	
91-6	17:7893	OSTI; NTIS (US Sales Only); INIS		DE92751044	
KFK–					
4735	17:6798	OSTI; NTIS (US Sales Only); INIS		DE92750123	
4736	17:6604	OSTI; NTIS (US Sales Only); INIS		DE92759306	
4827	17:6727	OSTI; NTIS (US Sales Only); INIS		DE92750150	
4837	17:6573	OSTI; NTIS (US Sales Only); INIS		DE92759305	
4842	17:7554	OSTI; NTIS (US Sales Only)		DE92759329	
4850	17:6728	OSTI; NTIS (US Sales Only); INIS		DE92758922	
4861	17:6936	OSTI; NTIS (US Sales Only); INIS		DE92758916	
4891	17:6740	OSTI; NTIS (US Sales Only); INIS		DE92750188	
4894	17:7012	OSTI; NTIS (US Sales Only); INIS		DE92750200	
4906	17:7585	OSTI; NTIS (US Sales Only)		DE92759286	
4917	17:8203	OSTI; NTIS (US Sales Only); INIS		DE92759010	
4919	17:7089	OSTI; NTIS (US Sales Only)		DE92750159	
4920	17:7183	OSTI; NTIS (US Sales Only); INIS		DE92750156	
4923	17:6870	OSTI; NTIS (US Sales Only)		DE92750259	
KFTI–					
89-30	17:8294	OSTI; NTIS (US Sales Only); INIS		DE92609370	
89-31	17:8295	OSTI; NTIS (US Sales Only); INIS		DE92609371	
89-48	17:8296	OSTI; NTIS (US Sales Only); INIS		DE92609372	
89-54	17:7281	OSTI; NTIS (US Sales Only); INIS		DE92610955	
89-59	17:8297	OSTI; NTIS (US Sales Only); INIS		DE92609545	
KURRI-TR–					
349	17:6399	OSTI; NTIS (US Sales Only); INIS		DE92751060	
352	17:7736	OSTI; NTIS (US Sales Only); INIS		DE92751061	
353	17:8389	OSTI; NTIS (US Sales Only); INIS		DE92751062	
LA–					
11810-MS	17:7536	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92005354	PC-700
11855-MS	17:7537	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92004339	PC-700
11880-MS	17:7538	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004751	MF-700
12064-MS	17:7539	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004340	PC-900; PC-700
12121-MS	17:6400	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004645	MF-902
12173-MS	17:7522	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003735	PC-706; PC-741
12188-MS	17:7523	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005351	PC-706; PC-741
12189-MS	17:7236	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92003009	PC-940
12191-M	17:6595	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92002696	MF-731
12209-T	17:8116	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003621	MF-413
12214-M	17:6473	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92004116	MF-700
12216-MS	17:6401	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004341	PC-940
12222-PR	17:6460	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005352	MF-902; MF-907
LA-UR–					
91-1990	17:6543	OSTI; NTIS; GPO Dep.	E 1.99:	DE91014743	MF-251
91-2434	17:6608	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92002514	MF-743
91-3391	17:7644	OSTI; NTIS; GPO Dep.	E 1.99:	DE92002541	MF-908
91-3436	17:7253	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004653	MF-414
91-3489	17:7447	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92003798	MF-706
91-3497	17:8040	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003796	MF-413
91-3514	17:7448	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003865	MF-700
91-3526	17:7212	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003863	MF-706
91-3553	17:7449	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005021	MF-414
91-3559	17:6474	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003856	MF-731
91-3657	17:7450	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003727	MF-721
91-3692	17:7859	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003784	MF-906
91-3693	17:8380	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003783	MF-902
91-3715	17:7638	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003782	
91-3716	17:7639	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003781	
91-3717	17:8204	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003871	MF-910
91-3719	17:8041	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003870	MF-413
91-3749	17:7529	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92003793	MF-700
91-3849	17:8149	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005020	MF-700
91-3851	17:8194	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005018	MF-413; MF-404
91-3871	17:7451	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005016	MF-910

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
91-3908	17:7357	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005073	MF-413
91-3950	17:7555	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005068	MF-902
91-3962	17:7959	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005067	MF-414
91-3982	17:7013	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005066	MF-404
91-4035	17:6402	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005058	MF-814
91-4080	17:8298	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005053	MF-424
91-4097	17:8171	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005052	MF-901
91-4101	17:7860	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004580	MF-414
91-4150	17:7358	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004576	MF-421
91-4165	17:7861	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004574	MF-700
LAMP–					
91/2	17:7211	OSTI; NTIS (US Sales Only); INIS		DE92611160	
91/3	17:8155	OSTI; NTIS (US Sales Only); INIS		DE92609186	
91/5	17:7486	OSTI; NTIS (US Sales Only); INIS		DE92611161	
91/6	17:8142	OSTI; NTIS (US Sales Only); INIS		DE92615399	
91/7	17:7858	OSTI; NTIS (US Sales Only); INIS		DE92615237	
LAO–					
2732-2172	17:8145	*See* EGG–10617-5093			
LBL–					
29964	17:6985	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004425	MF-404; MF-406
29973-Rev.	17:7359	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004305	MF-414
30104	17:8443	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004304	MF-405
30456	17:7505	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003902	MF-404; MF-414
30457	17:7385	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003969	MF-406
30529	17:8364	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004686	MF-420
30606	17:7452	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004094	MF-406
30672	17:7360	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003907	MF-414
30674	17:7282	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003908	MF-414
30693	17:6937	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004320	MF-404
30729	17:6938	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004168	MF-404
30850	17:7819	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004171	MF-402
31121	17:7506	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004159	MF-408
31157	17:8205	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004306	MF-404
31242	17:7283	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003903	MF-414
31274	17:7923	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004177	MF-410
31312	17:7090	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004307	MF-401
31325	17:7894	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004169	MF-414
31347	17:7142	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004098	
31383	17:7453	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004099	MF-410
31390	17:7014	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004105	MF-404
31415	17:7454	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004172	MF-413
31422	17:7786	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004095	MF-414
31434	17:7386	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004097	MF-414
31459	17:7091	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003913	MF-401
31466	17:7101	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004001	MF-401
31571	17:7369	*See* SSCL-Preprint–6			
LITH-MAT-R–					
89-38	17:7835	OSTI; NTIS (US Sales Only); INIS		DE92614129	
LIU-TEK-LIC–					
1991-26	17:7836	OSTI; NTIS (US Sales Only); INIS		DE92614130	
LNS–					
160	17:8206	OSTI; NTIS (US Sales Only); INIS		DE92615534	
LRP–					
429/91	17:8299	OSTI; NTIS (US Sales Only); INIS		DE92614469	
430/91	17:8444	OSTI; NTIS (US Sales Only); INIS		DE92614099	
432/91	17:8300	OSTI; NTIS (US Sales Only); INIS		DE92614479	
433/91	17:8301	OSTI; NTIS (US Sales Only); INIS		DE92614470	
434/91	17:8302	OSTI; NTIS (US Sales Only); INIS		DE92614471	
435/91	17:8303	OSTI; NTIS (US Sales Only); INIS		DE92614451	
436/91	17:8304	OSTI; NTIS (US Sales Only); INIS		DE92614459	
438/91	17:8305	OSTI; NTIS (US Sales Only); INIS		DE92614433	
LUMEDW-MEXL–					
1022-1991	17:7677	OSTI; NTIS (US Sales Only); INIS		DE92613633	
LYCEN–					
91-06	17:7960	OSTI; NTIS (US Sales Only)		DE92743610	
MAFF-AEMR–					
19	17:7624	OSTI; NTIS (US Sales Only); INIS		DE92614891	
MAFF-AEPAM–					
7	17:7054	OSTI; NTIS (US Sales Only); INIS		DE92614732	

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MISC–					
89083	17:6507	*See* DOE/ID–10237(90-91)			
MIT-ANP-TR–					
001	17:6605	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004771	MF-530
MLM–					
3709	17:7015	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004777	PC-701
3711	17:8445	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003738	PC-706
3714(OP)	17:7478	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004008	MF-706
3720(OP)	17:7016	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004009	MF-704; MF-706
3722	17:8408	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004581	PC-705
3723(OP)	17:6403	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004005	MF-706
3724(OP)	17:6475	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004011	MF-706
3725(OP)	17:7479	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004007	MF-706
3726(OP)	17:6404	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004006	MF-706
3727(OP)	17:6405	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004012	MF-706
3728(OP)	17:6406	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004004	MF-706
3729(OP)	17:6407	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004010	MF-706; MF-702
MPE–					
225	17:7455	OSTI; NTIS (US Sales Only); INIS		DE92758917	
MPL-U–					
17/89	17:7820	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004772	MF-405
MTR–					
90W00467	17:6744	*See* NUREG/CR–5382			
NDP–					
020/R1	17:7556	*See* ORNL/CDIAC–37			
NEGE–					
0001.	17:6320	*See* CNIC–00449			
NEI-SE–					
68	17:8390	OSTI; NTIS (US Sales Only); INIS		DE92614119	
90	17:7625	OSTI; NTIS (US Sales Only); INIS		DE92613509	
91	17:7787	OSTI; NTIS (US Sales Only); INIS		DE92613597	
NIFS–					
100	17:8306	OSTI; NTIS (US Sales Only); INIS		DE92751077	
101	17:8365	OSTI; NTIS (US Sales Only); INIS		DE92750965	
102	17:8307	OSTI; NTIS (US Sales Only); INIS		DE92750966	
NIFS-MEMO–					
1	17:8308	OSTI; NTIS (US Sales Only); INIS		DE92750824	
2	17:8366	OSTI; NTIS (US Sales Only); INIS		DE92750825	
NIKHEF-H–					
91-11	17:7456	OSTI; NTIS (US Sales Only); INIS		DE92613872	
91-13	17:7924	OSTI; NTIS (US Sales Only); INIS		DE92614181	
91-14	17:7457	OSTI; NTIS (US Sales Only); INIS		DE92613878	
91-15	17:7961	OSTI; NTIS (US Sales Only); INIS		DE92614204	
91-17	17:7925	OSTI; NTIS (US Sales Only); INIS		DE92614188	
91-18	17:7895	OSTI; NTIS (US Sales Only); INIS		DE92614148	
91-19	17:7926	OSTI; NTIS (US Sales Only); INIS		DE92614182	
91-21	17:7458	OSTI; NTIS (US Sales Only); INIS		DE92613879	
91-22	17:7927	OSTI; NTIS (US Sales Only); INIS		DE92614183	
91-23	17:7459	OSTI; NTIS (US Sales Only); INIS		DE92613880	
91-24	17:7928	OSTI; NTIS (US Sales Only); INIS		DE92614184	
NKS–					
91-1	17:6408	OSTI; NTIS (US Sales Only); INIS		DE92614970	
NPL-RSA(EXT)–					
15	17:7788	OSTI; NTIS (US Sales Only); INIS		DE92614986	
NREL/TP–					
214-4459	17:6520	OSTI; NTIS; GPO Dep.	E 1.99:	DE91015005	MF-270
214-4468	17:6521	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001168	MF-273
214-4480	17:6522	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001152	MF-270
214-4486	17:6539	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001170	MF-275
214-4489	17:6523	OSTI; NTIS; GPO Dep.	E 1.99:	DE91015025	MF-270
214-4498	17:6524	OSTI; NTIS; GPO Dep.	E 1.99:	DE91015029	MF-275
214-4502	17:6525	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001171	MF-273
214-4503	17:6526	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001172	MF-270
214-4569	17:6516	OSTI; NTIS; GPO Dep.	E 1.99:	DE91015032	MF-270
214-4610	17:6527	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001196	MF-273
232-4237	17:6865	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001174	MF-249
257-4510	17:6547	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001157	MF-261
257-4518	17:6548	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001190	MF-261
257-4625	17:6549	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001189	MF-261

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NUB–					
3025	17:7877	*See* IC–91/124			
NUREG–					
0304-Vol.16-No.2	17:6612	OSTI; NTIS; INIS; GPO		TI92004811	
0383-Vol.3-Rev.11	17:6364	OSTI; NTIS; INIS; GPO		TI92003138	
0750-Vol.34-No.3	17:6613	OSTI; NTIS; INIS; GPO		TI92003809	
0750-Vol.34-No.4	17:6614	OSTI; NTIS; INIS; GPO		TI92004887	
0847-Suppl.7	17:6741	OSTI; NTIS; INIS; GPO		TI92002922	
0936-Vol.10-No.3	17:6615	OSTI; NTIS; INIS; GPO		TI92002877	
0940-Vol.10-No.3	17:6616	OSTI; NTIS; INIS; GPO		TI92004104	
1322	17:6476	OSTI; NTIS; INIS; GPO		TI92001866	
1362	17:6617	OSTI; NTIS; INIS; GPO		TI92004277	
1363-Vol.3	17:6618	OSTI; NTIS; INIS; GPO		TI92002305	
1398	17:6619	OSTI; NTIS; INIS; GPO		TI92004275	
1412	17:6620	OSTI; NTIS; INIS; GPO		TI92004035	
1428	17:6621	OSTI; NTIS; INIS; GPO		TI92004276	
1435-Suppl.1	17:6742	OSTI; NTIS; INIS; GPO		TI92005099	
NUREG/CR–					
2000-Vol.10-No.10	17:6623	OSTI; NTIS; INIS; GPO		TI92004813	
2000-Vol.10-No.9	17:6622	OSTI; NTIS; INIS		TI92003388	
5345	17:6666	OSTI; NTIS; INIS; GPO		TI92004726	
5352-Rev.1	17:6409	OSTI; NTIS; INIS; GPO		TI92003623	
5382	17:6744	OSTI; NTIS; INIS; GPO		TI92004282	
5520	17:6745	OSTI; NTIS; GPO		TI92003683	
5623	17:6746	OSTI; NTIS; INIS; GPO		TI92003644	
5645	17:6574	OSTI; NTIS; INIS; GPO		TI92004727	
5712	17:6747	OSTI; NTIS; INIS; GPO		TI92003495	
5722	17:6477	OSTI; NTIS; INIS; GPO		TI92003139	
5728	17:6748	OSTI; NTIS; INIS; GPO		TI92002692	
5734	17:6328	OSTI; NTIS; INIS; GPO		TI92004103	
5765	17:6749	OSTI; NTIS; INIS; GPO		TI92003256	
5781	17:6750	OSTI; NTIS; INIS; GPO		TI92004102	
5795	17:6410	OSTI; NTIS; INIS; GPO		TI92003389	
5796	17:6585	OSTI; NTIS; INIS; GPO		TI92004287	
5798	17:7678	OSTI; NTIS; INIS; GPO		TI92001867	
5808	17:6667	OSTI; NTIS; INIS; GPO		TI92005370	
NUREG/IA–					
00103.	17:7184	*See* PSI–104			
OCS/EIS/EA/MMS–					
91-0054-Vol.1	17:6306	OSTI; Minerals Management Service, Gulf of Mexico OCS Region, 1201 Elmwood Park Blvd., New Orleans, LA 70123-2394		TI92003675	
91-0054-Vol.2	17:6307	OSTI; Minerals Management Service, Gulf of Mexico OCS Region, 1201 Elmwood Park Blvd., New Orleans, LA 70123-2394		TI92004694	
ORAU–					
91/J-20	17:6461	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004014	
ORNL–					
6022	17:6697	OSTI; NTIS; GPO Dep.	E 1.99:	DE92002276	MF-700
6635/V2	17:7387	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004584	PC-506
6650	17:6194	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004596	MF-101
6658/R10	17:6789	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004594	MF-630
6658/R9	17:6788	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004590	MF-630
6683	17:6822	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004085	
6684	17:7517	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004599	
6697	17:6790	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004587	MF-721
ORNL/ATD–					
54/R1	17:7017	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005405	MF-404
62	17:7018	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004093	MF-404
63	17:7019	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005313	MF-404
ORNL/CDIAC–					
37	17:7556	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004582	MF-402
ORNL/CON–					
340	17:6824	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004595	MF-350
342	17:6871	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004600	MF-350
ORNL/CSD/TM–					
268	17:6575	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002402	PC-820
ORNL/ER–					
36	17:6411	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003728	MF-902
46	17:7626	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002379	MF-903
60	17:6462	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003745	MF-902

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
61	17:6593	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003746	MF-902
65	17:8409	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004585	MF-902
ORNL/ER/Sub–					
90-KA931/2	17:7821	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003674	MF-902
ORNL/HTSPC–					
1	17:6766	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004108	MF-220
ORNL/M–					
1157	17:7586	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005089	MF-402
1223	17:7055	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004043	MF-401
1327	17:6412	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004901	MF-902
1442	17:6413	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004903	MF-902
1809	17:7627	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003550	MF-902
ORNL/NSIC–					
200-Vol.10-No.10	17:6623	*See* NUREG/CR–2000-Vol.10-No.10			
200-Vol.10-No.9	17:6622	*See* NUREG/CR–2000-Vol.10-No.9			
ORNL/PPA–					
90/1	17:6795	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004801	MF-900
ORNL/RASA–					
89/18	17:6463	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004589	MF-902
ORNL/Sub–					
85-55901/02	17:6986	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003765	MF-114
90-SF204/1	17:7020	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004905	MF-350
ORNL/TM–					
11644	17:6746	*See* NUREG/CR–5623			
11703	17:6843	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004908	MF-350
11787	17:6289	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003947	MF-950
11792	17:6327	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004886	MF-501
11797	17:8410	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004292	
11798	17:6414	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004597	MF-902
11823	17:6747	*See* NUREG/CR–5712			
11851	17:6505	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004588	MF-371
11854	17:7361	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004106	MF-414
11873	17:8133	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005175	
11883/R1	17:7587	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005306	MF-402
11886	17:7628	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004598	MF-402
11891	17:6415	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004885	MF-721
11899	17:8411	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004700	MF-408
11903	17:8412	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004086	MF-405
11907	17:6751	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002401	PC-523
11928	17:7362	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004107	MF-414
11933	17:7518	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004593	
11934	17:8413	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004021	
11951	17:8414	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004592	MF-700
11960	17:8415	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004167	MF-405
11970	17:6667	*See* NUREG/CR–5808			
11986	17:8416	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004166	MF-405
12003	17:8417	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004087	MF-405
12005	17:7507	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005518	MF-404
12006	17:8418	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004291	MF-408
PATENTS-					
	17:6295	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $4.00 CAN; MF $2.75 CAN			
	17:6301	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $4.00 CAN; MF $2.75 CAN			
	17:6308	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $4.00 CAN; MF $2.75 CAN			
	17:6310	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $4.00 CAN; MF $2.75 CAN			
	17:6312	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $4.00 CAN; MF $2.75 CAN			

PATENTS-

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
	17:6314	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $4.00 CAN; MF $2.75 CAN			
	17:6315	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $4.00 CAN; MF $2.75 CAN			
	17:6316	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $4.00 CAN; MF $2.75 CAN			
	17:6504	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $4.00 CAN; MF $2.75 CAN			
	17:6513	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $4.00 CAN; MF $2.75 CAN			
	17:6765	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $4.00 CAN; MF $2.75 CAN			
	17:6771	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $4.00 CAN; MF $2.75 CAN			
	17:6772	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $4.00 CAN; MF $2.75 CAN			
	17:6879	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $4.00 CAN; MF $2.75 CAN			
	17:6880	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $4.00 CAN; MF $2.75 CAN			
	17:7036	Micromedia Ltd., Technical Information Centre, 165 Hotel de Ville, Place du Portage, Phase 2, Hull, Quebec, Canada J8X 3X2. Prices: PC $4.00 CAN; MF $2.75 CAN			
PATENTS-US–					
A516590	17:7487	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004609	MF-506
A7428536	17:8367	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003831	MF-706
A7502956	17:7524	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92003832	MF-706
A7502957	17:6866	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003833	MF-721
A7502959	17:8419	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003834	MF-706
A7502960	17:7159	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003835	MF-706
A7502962	17:7160	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003836	MF-706
A7504152	17:7161	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003837	MF-506
A7504217	17:7021	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003838	MF-701
A7504218	17:7488	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003839	MF-506
A7504223	17:6502	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003840	MF-408
A7506125	17:6416	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003841	MF-406
A7506126	17:7162	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003842	MF-706
A7506739	17:6195	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003874	MF-108
A7506741	17:7508	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003875	MF-706; MF-703
A7509121	17:7460	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003876	MF-406; MF-407
A7511372	17:7476	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004602	MF-706
A7511684	17:6939	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004603	MF-704
A7515307	17:7163	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004605	
A7516399	17:7480	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004606	MF-706
A7516400	17:7588	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004607	MF-502
A7516401	17:7461	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003830	MF-406
A7516402	17:7462	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004608	MF-700
A7516611	17:6196	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004610	MF-113

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
A7516935	17:7022	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004611	MF-704
A7520475	17:7213	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004613	MF-706
A7522016	17:7164	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004614	MF-706
A7522877	17:7509	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004615	MF-506
A7524114	17:7489	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004616	MF-706
A7524118	17:7490	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004617	MF-706
A7525572	17:7092	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004618	MF-248
A7529403	17:7510	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004619	MF-501
A7530513	17:7214	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004620	
A7530672	17:7056	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004621	MF-706
A7530673	17:7491	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003980	MF-506
A7530693	17:7640	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004622	MF-408
A7531355	17:6650	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003661	MF-523
A7531356	17:7511	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003662	MF-506
A7531363	17:6987	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003729	MF-704
A7531437	17:7215	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003740	MF-706
A7531487	17:7165	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003777	MF-506
A7531492	17:7512	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003778	MF-706
A7531722	17:6197	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003741	MF-108
A7532545	17:6762	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003742	MF-406
A7534897	17:7166	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003743	MF-506
A7535007	17:7023	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003744	MF-704
A7537957	17:6528	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003686	MF-270
A7539392	17:6988	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003749	MF-704
A7539493	17:7679	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003750	MF-408
A7540237	17:7216	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003810	MF-706
A7540240	17:7463	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003811	MF-706
A7541992	17:6561	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003812	MF-105
A7542215	17:8446	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003813	MF-506
A7542604	17:7057	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003814	MF-108
A7543897	17:6940	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003815	MF-504
A7545732	17:7492	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003816	MF-406
A7546827	17:6752	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003817	MF-506
A7547370	17:6941	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003818	MF-506; MF-504
A7547748	17:7363	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003819	MF-411
A7549982	17:6753	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003820	MF-506
A7550280	17:7167	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003821	MF-706
A7551387	17:7168	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003822	MF-406
A7551834	17:7513	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003823	MF-706
A7554728	17:6872	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003824	MF-706
A7559030	17:7217	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003825	MF-406
A7559234	17:7024	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003826	MF-701
A7560666	17:6198	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003827	MF-105
A7560667	17:7464	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003828	MF-706
PCCF-RI–					
90-16	17:7465	OSTI; NTIS (US Sales Only)		DE92733612	
PNL–					
6450-47-HEDR	17:7557	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003961	MF-707
7479	17:6574	*See* NUREG/CR–5645			
7713-HEDR	17:8381	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004564	MF-600
7723	17:6749	*See* NUREG/CR–5765			
7781	17:7558	OSTI; NTIS; GPO Dep.	E 1.99:	DE92001826	
7822	17:6417	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002216	MF-940
7830-Vol.2	17:6503	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003844	MF-245
7836	17:7629	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004452	MF-902
7857	17:6418	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003901	MF-510
7868-HEDR	17:7559	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004640	MF-707
7869-HEDR	17:7630	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003984	MF-707
7871	17:6478	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004849	MF-731
7876	17:7631	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004709	
7889	17:6844	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004449	MF-350
7927	17:7589	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005174	
7964	17:7560	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005356	MF-602
PNL-SA–					
18065	17:6643	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004516	MF-504
19346	17:8368	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004505	MF-423
19355	17:7806	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004506	MF-500
19386	17:8369	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004511	MF-423
19387	17:8370	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004504	MF-423
19551	17:6659	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002701	MF-520

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
19571	17:8371	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004512	MF-423
19675	17:6791	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004703	MF-402
19681	17:6361	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92002698	MF-526
19687	17:6989	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004486	MF-504
19779	17:7590	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002142	MF-511
19782	17:6942	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004515	MF-404
19867	17:6419	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002158	MF-820
20045	17:6420	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002741	MF-802
20093	17:6644	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002736	
20116	17:7808	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004502	MF-607
20244	17:6943	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004509	MF-504
POEF-T–					
3581-Extd.Abst.	17:7058	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003981	MF-501
POEF/ER/Sub–					
88/4523	17:7591	OSTI; NTIS; GPO Dep.	E 1.99:	DE92002247	MF-630
PPPL–					
2784	17:8309	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005130	PC-420; PC-426; PC-427
2788	17:8372	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005129	PC-420
2802	17:8310	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005131	PC-420; PC-421; PC-426
2808	17:8311	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005132	PC-420; PC-421; PC-427
PSI–					
103	17:7592	OSTI; NTIS (US Sales Only); INIS		DE92613488	
104	17:7184	OSTI; NTIS (US Sales Only); INIS		DE92613719	
105	17:7593	OSTI; NTIS (US Sales Only); INIS		DE92613460	
106	17:7594	OSTI; NTIS (US Sales Only); INIS		DE92613461	
107	17:6634	OSTI; NTIS (US Sales Only); INIS		DE92613777	
108	17:6576	OSTI; NTIS (US Sales Only); INIS		DE92613804	
109	17:7093	OSTI; NTIS (US Sales Only); INIS		DE92614765	
97	17:6586	OSTI; NTIS (US Sales Only); INIS		DE92613818	
PTB-Opt–					
31	17:6529	OSTI; NTIS (US Sales Only)		DE92758945	
RAL–					
91-054	17:6845	OSTI; NTIS (US Sales Only)		DE92750020	
RCNP-P–					
114	17:8117	OSTI; NTIS (US Sales Only); INIS		DE92751063	
RFP–					
4349	17:7530	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005227	PC-704
4479	17:6421	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004800	PC-702
4488	17:7169	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92004799	PC-706
4509	17:7170	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003637	MF-707
4528	17:6990	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004002	MF-704
4530	17:6365	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004003	MF-701
RPI–					
N76-91	17:7910	*See* DOE/ER/40561–25			
RR–					
411.	17:6580	*See* INIS-GB–376			
413.	17:6579	*See* INIS-GB–375			
RT/AMB–					
90-35	17:6862	*See* ENEA-RT-AMB–90-35			
90-47	17:7484	*See* ENEA-RT-AMB–90-47			
RT/INN–					
90-17	17:7201	*See* ENEA-RT-INN–90-17			
90-32	17:7260	*See* ENEA-RT-INN–90-32			
90-38	17:7203	*See* ENEA-RT-INN–90-38			
90-39	17:7202	*See* ENEA-RT-INN–90-36			
90-49	17:7261	*See* ENEA-RT-INN–90-49			
90-50	17:7262	*See* ENEA-RT-INN–90-50			
90-51	17:7204	*See* ENEA-RT-INN–90-51			
90-52	17:7485	*See* ENEA-RT-INN–90-52			
90-54	17:7263	*See* ENEA-RT-INN–90-54			
90-55	17:7205	*See* ENEA-RT-INN–90-55			
90-56	17:6974	*See* ENEA-RT-INN–90-56			
90-57	17:7206	*See* ENEA-RT-INN–90-57			
90-58	17:7207	*See* ENEA-RT-INN–90-58			
90-59	17:7208	*See* ENEA-RT-INN–90-59			

Report Number	*Abstract Number*	*Source of Availability*	*GPO Dep.*	*Order Number*	*Distribution Category*
90-60	17:7264	*See* ENEA-RT-INN–90-60			
90-66	17:7209	*See* ENEA-RT-INN–90-66			
90-68	17:7265	*See* ENEA-RT-INN–90-68			
90-71	17:7210	*See* ENEA-RT-INN–90-71			
90-72	17:7267	*See* ENEA-RT-INN–90-72			
RT/NUCL–					
90-04	17:8239	*See* ENEA-RT-NUCL–90-04			
90-13	17:8252	*See* ENEA-RT-NUCL–90-13			
90-15	17:8334	*See* ENEA-RT-NUCL–90-15			
90-22	17:7549	*See* ENEA-RT-NUCL–90-22			
90-24	17:6469	*See* ENEA-RT-NUCL–90-24			
90-26	17:6916	*See* ENEA-RT-NUCL–90-26			
90-28	17:8335	*See* ENEA-RT-NUCL–90-28			
90-29	17:8253	*See* ENEA-RT-NUCL–90-29			
90-36	17:8336	*See* ENEA-RT-NUCL–90-36			
90-37	17:8254	*See* ENEA-RT-NUCL–90-37			
90-39	17:8255	*See* ENEA-RT-NUCL–90-39			
90-40	17:8256	*See* ENEA-RT-NUCL–90-40			
90-41	17:8337	*See* ENEA-RT-NUCL–90-41			
90-44	17:8338	*See* ENEA-RT-NUCL–90-44			
90-46	17:7002	*See* ENEA-RT-NUCL–90-46			
90-47	17:6975	*See* ENEA-RT-NUCL–90-47			
90-48	17:8339	*See* ENEA-RT-NUCL–90-48			
SAND–					
86-7006	17:7595	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004787	MF-814
87-2777	17:6422	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005385	MF-814
88-3164	17:6423	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003612	MF-814
88-7065	17:6424	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004786	MF-814
89-0308	17:6666	*See* NUREG/CR–5345			
89-0837	17:6425	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004788	MF-814
89-1989	17:6426	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004789	MF-814
89-2075	17:6804	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005369	MF-700
89-7023	17:6427	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004785	MF-814
90-1162	17:6533	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004784	MF-236
90-2261	17:6428	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004301	MF-814
90-2624	17:6534	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003952	MF-237
90-2711	17:7531	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92004115	MF-700
90-2748	17:6429	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004790	MF-721
90-8248	17:7532	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004679	MF-700
91-0269	17:6430	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003589	MF-903
91-0430	17:7596	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003945	MF-721; MF-701
91-0679C	17:6944	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003577	MF-704
91-0893/1	17:6431	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005044	MF-721
91-0893/2	17:6432	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004914	MF-900
91-0893/3	17:6433	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004981	MF-900
91-0948	17:6477	*See* NUREG/CR–5722			
91-0955	17:7519	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004758	MF-706
91-1064	17:7171	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003340	PC-722
91-1105	17:6748	*See* NUREG/CR–5728			
91-1163C	17:8373	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003648	MF-423
91-1367C	17:7218	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004742	MF-706
91-1392C	17:7025	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004351	MF-404
91-1397C	17:6754	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003615	
91-1459C	17:6755	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004013	
91-1477C	17:7026	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004354	MF-704
91-1508C	17:8195	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004211	MF-411
91-1610C	17:6756	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003617	
91-1633C	17:8420	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003640	MF-706
91-1635C	17:7027	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004737	MF-704
91-1700C	17:8374	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92004212	MF-704
91-1732	17:6945	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003944	MF-706
91-1752	17:8421	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004113	MF-705
91-1803C	17:7028	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003957	MF-704
91-1827C	17:6434	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003297	
91-1848C	17:6544	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004209	MF-253
91-1882	17:7525	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92004782	MF-700
91-2099C	17:6435	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002013	MF-902
91-2150	17:7862	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004114	MF-706
91-2204	17:7172	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92004783	MF-722
91-2211C	17:6532	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004734	MF-276

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91-2247C	17:6436	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003626	MF-906
91-2263C	17:6946	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003949	MF-704
91-2303C	17:7514	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92002361	MF-706
91-2310C	17:6698	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92003298	MF-743
91-2315C	17:6609	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92002923	MF-528
91-2328	17:7533	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92004853	MF-706
91-2376C	17:7515	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92004732	MF-741
91-2386C	17:6550	OSTI; NTIS; GPO Dep.	E 1.99:	DE92002931	MF-261
91-2399C	17:6947	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004740	MF-706
91-2407C	17:6757	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004729	
91-2408C	17:6517	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004733	MF-276
91-2451C	17:7467	OSTI; NTIS; GPO Dep.	E 1.99:	DE92002988	MF-706
91-2461C	17:6758	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004743	
91-2486C	17:7526	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92002932	MF-706
91-2493C	17:7094	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004216	MF-704
91-2509C	17:7029	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004728	MF-701
91-2515C	17:6530	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004741	MF-274
91-2529C	17:6768	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004739	MF-706
91-2533C	17:6948	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003954	MF-704; MF-706
91-2587C	17:7284	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003956	MF-712
91-2599C	17:6518	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004735	MF-276
91-2606C	17:6949	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003958	MF-906
91-2613C	17:6759	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004355	MF-523
91-2661C	17:6950	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003948	MF-906
91-2694	17:6769	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004854	MF-212
91-2705C	17:7475	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92003950	MF-706
91-2752C	17:6951	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004397	MF-704
91-2826C	17:7030	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004353	MF-404
91-2864	17:8422	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005563	MF-705
91-7008	17:6540	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004475	MF-237
91-7013	17:6531	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004781	MF-274
91-7014	17:6519	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004851	MF-235
91-7073	17:6587	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005353	PC-523
91-8703	17:7059	OSTI; NTIS; GPO Dep.	E 1.99:	DE92005331	MF-411; MF-310
SINR–					
0001.	17:7131	*See* CNIC–00410			
SIP–					
0041.	17:8209	*See* CNIC–00425			
SKB-TR–					
90-14	17:7597	OSTI; NTIS (US Sales Only); INIS		DE92613489	
90-15	17:7632	OSTI; NTIS (US Sales Only); INIS		DE92613512	
90-19	17:7598	OSTI; NTIS (US Sales Only); INIS		DE92613462	
90-22	17:7599	OSTI; NTIS (US Sales Only); INIS		DE92613490	
90-45	17:7095	OSTI; NTIS (US Sales Only); INIS		DE92613324	
91-15	17:7096	OSTI; NTIS (US Sales Only); INIS		DE92613325	
91-18	17:8423	OSTI; NTIS (US Sales Only); INIS		DE92614105	
91-19	17:8424	OSTI; NTIS (US Sales Only); INIS		DE92614106	
91-22	17:7600	OSTI; NTIS (US Sales Only); INIS		DE92613491	
91-24	17:7601	OSTI; NTIS (US Sales Only); INIS		DE92613492	
91-25	17:7602	OSTI; NTIS (US Sales Only); INIS		DE92613493	
91-26	17:8425	OSTI; NTIS (US Sales Only); INIS		DE92614107	
91-27	17:8426	OSTI; NTIS (US Sales Only); INIS		DE92614108	
91-30	17:8427	OSTI; NTIS (US Sales Only); INIS		DE92614109	
91-31	17:8428	OSTI; NTIS (US Sales Only); INIS		DE92614110	
91-35	17:6437	OSTI; NTIS (US Sales Only); INIS		DE92613959	
SKN–					
50	17:6799	OSTI; NTIS (US Sales Only); INIS		DE92614084	
SLAC-PUB–					
5294	17:7285	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004715	MF-414
5640	17:7364	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE91018883	MF-414
5642-Rev.	17:7468	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004947	MF-414
5669	17:7962	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004775	MF-414
5678	17:7469	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004948	MF-414
5682	17:7994	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004713	MF-414
5695	17:7286	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004712	MF-414
5698	17:7365	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004774	MF-414
5700	17:7287	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004949	MF-414
5709	17:7254	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004773	MF-414
5710	17:7995	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004745	MF-414

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5716	17:7288	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92006432	MF-414
SMC–					
0044.	17:7739	*See* CNIC–00408			
0045.	17:7740	*See* CNIC–00415			
0046.	17:7741	*See* CNIC–00429			
0047.	17:7742	*See* CNIC–00433			
SPE–					
22816	17:6783	*See* EGG–10617-2093			
SSCL–					
340	17:7366	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004112	PC-414
479	17:7367	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005177	MF-414
503	17:7306	*See* FNAL/C–91/218			
541	17:7308	*See* FNAL/C–91/254			
542	17:7309	*See* FNAL/C–91/255			
559	17:7368	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004955	PC-414
SSCL-Preprint–					
6	17:7369	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004526	MF-414
SSCL-SR–					
1181	17:7869	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004300	PC-414
STARS–					
5.	17:6576	*See* PSI–108			
STRIPA-IR–					
91-02	17:7603	OSTI; NTIS (US Sales Only); INIS		DE92613494	
91-12	17:7604	OSTI; NTIS (US Sales Only); INIS		DE92613495	
91-15	17:7605	OSTI; NTIS (US Sales Only); INIS		DE92613496	
STRIPA-TR–					
91-07	17:7606	OSTI; NTIS (US Sales Only); INIS		DE92613497	
91-10	17:7607	OSTI; NTIS (US Sales Only); INIS		DE92613498	
91-11	17:7608	OSTI; NTIS (US Sales Only); INIS		DE92613499	
91-14	17:7609	OSTI; NTIS (US Sales Only); INIS		DE92613500	
STU-I–					
773-1990	17:7195	OSTI; NTIS (US Sales Only); INIS		DE92613770	
774-1990	17:7196	OSTI; NTIS (US Sales Only); INIS		DE92613771	
SV-U–					
91-41	17:6577	OSTI; NTIS (US Sales Only); INIS		DE92615103	
TKK-KO/LTK–					
44	17:6770	OSTI; NTIS (US Sales Only)		DE92728394	
TR–					
91-13	17:8158	*See* DOE/ER/25061–T1			
TRITA-PFU–					
90-13	17:8312	OSTI; NTIS (US Sales Only); INIS		DE92614472	
91-05	17:8313	OSTI; NTIS (US Sales Only); INIS		DE92614452	
91-06	17:8314	OSTI; NTIS (US Sales Only); INIS		DE92614440	
91-07	17:8315	OSTI; NTIS (US Sales Only); INIS		DE92614453	
91-08	17:8316	OSTI; NTIS (US Sales Only); INIS		DE92614460	
TTC–					
1033	17:6575	*See* ORNL/CSD/TM–268			
1071	17:7171	*See* SAND–91-1064			
TU–					
0010.	17:6324	*See* CNIC–00395			
UC-BFE–					
027	17:8329	*See* DOE/ER/52154–T4			
UCB-PTH–					
91/46	17:7923	*See* LBL–31274			
91/50	17:7894	*See* LBL–31325			
UCID–					
20879	17:7822	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004465	MF-703
21414-Rev.1	17:6438	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004466	MF-814
21756	17:7173	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004467	MF-814
UCLA-PPG–					
1380	17:8375	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92006426	PC-421; PC-423
UCRL-CR–					
105696	17:7174	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004666	
105858-91-Summ.	17:7034	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003971	MF-700; MF-704
108117	17:7494	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92003985	MF-712
108120	17:7060	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003966	MF-703
108433	17:7863	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003970	MF-700
108459	17:7495	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003964	MF-700; MF-705

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108460	17:7232	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003965	MF-706
108465	17:7470	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003967	MF-706
UCRL-ID–					
106314	17:8432	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004629	MF-707
106454-91-1	17:6479	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE91015088	MF-700
107469	17:7610	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003048	MF-721
108153	17:6439	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004468	MF-814
108228	17:8433	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004631	MF-705
108241	17:7534	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004634	MF-703
108330	17:6956	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004469	MF-814
108489	17:7471	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004624	MF-700
108596	17:7175	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004625	MF-706
108736	17:7472	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004470	MF-706
109126	17:7864	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004472	MF-706
UCRL-JC–					
104008	17:8434	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004660	MF-405
104491	17:8435	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003977	MF-705
104494	17:6480	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003975	MF-700
106109-Rev.1	17:7561	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004665	MF-702
106720	17:6888	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003062	MF-700
106751	17:6300	OSTI; NTIS (US Sales Only); GPO Dep.	E 1.99:	DE92003700	MF-101
106759	17:6440	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004673	MF-814
106873	17:8376	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004160	MF-712
106916	17:6441	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004657	MF-814
106966-Rev.1	17:7562	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004663	MF-702
107037	17:7611	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003968	MF-702
107357	17:6699	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92002192	MF-700
107363	17:7233	OSTI; NTIS; GPO Dep.	E 1.99:	DE92003973	MF-712; MF-706
107425	17:8173	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92004667	MF-700
107675	17:8317	OSTI; NTIS; GPO Dep.	E 1.99:	DE92004654	MF-700
107982	17:7234	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92005248	MF-712
107983	17:7496	OSTI; NTIS; INIS; GPO Dep.	E 1.99:	DE92003972	MF-712; MF-706
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